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Some Uses of Cross-section Paper in the Machine Shop.

BY WM. O. WEBBER.

A very interesting series of facts can be arrived at in a simple and comprehensive way in machine shops making a specialty of any line of manufacture by plotting the weekly or monthly pay roll on a sheet of cross-section paper, and also the output of the shops for the same time.

See Fig. 1, in which the upper broken line represents the amount of weekly pay roll, the solid line the total horse-power of engines produced each week, and the bottom dot and dash line one item divided by the other, or the cost per horse-power. This shows at a glance that the 8x10 engine costs out of all proportion with the others, and also that the 8x12 and 9x12 want looking into, and also that it is better to mix large and small engines in the shop together than to run all one size.

Now plotting the 8x10 with the 8x12, see Figs. 2 and 3, we find the principal trouble is in the drilling and lathe work and shaper, and so know where to look.

Plotting the 8x12 and 9x12 the same way with the 10x12 would show where to look for leaks also.

This can also be carried further, and by plotting the different kinds and sizes of articles manufactured together with the pay roll, it can be readily ascertained which size or class of some one kind of product is the most and which the least profitable *to* produce. Again, having ascertained by this method which particular item of product is least profitable, we can now plot the amounts of each particular manipulation, such as lathe work, planing, milling, drilling, shaper, or vise work of this unprofitable item, together with a corresponding curve or diagram of one of the most profitable items, and ascertain at a glance where the trouble is, and where the effort must be concentrated to remedy this error.

It is surprising how much can be done by one smart young man who has had some experience himself in shop work in discovering and plugging up the leaks in a machine shop, by taking the time slips from each man and playing a sort of game of solitaire with them to determine the exact value of the different manipulations put into each different size or class of product, and it is as surprising to see how quickly your foreman of that department, if he is any good at all and fitted for his place, takes an interest in these figures and diagrams and tries to help you find the remedy; also the men. If you find, for instance, that your planing on a certain lot and size of engines runs higher in proportion than it ought and you look up the cause, you find that some one item of planer work was the cause of it. On this being traced down, it is discovered that on that particular lot of cylinders, for instance, there was from $\frac{3}{8}$ to $\frac{1}{2}$ inch too much stock on the valve seats, due to some trouble in the foundry (to be investigated in turn) and the time was used up in removing the surplus stock. Now this planer hand feels as sorry about this as though it were his own fault, and is very ready to make suggestions as to how it might best be remedied, and I have yet to find the case where this advice did not have some value. The moral effect of this system is also of great value, as it keeps the foreman and the hands on the jump all the time to see that one set of operations does not overrun the previous set of similar operations, and where it is obvious at a glance that some particular manipulation is going to overrun the average, the workman will notify the foreman and superintendent both, and they then hold a consultation to devise some special means whereby this particularly faulty lot can be carried along as to this specific manipulation within the usual and average time, and perhaps by so doing discover a better and more expeditious method of doing all future lots.

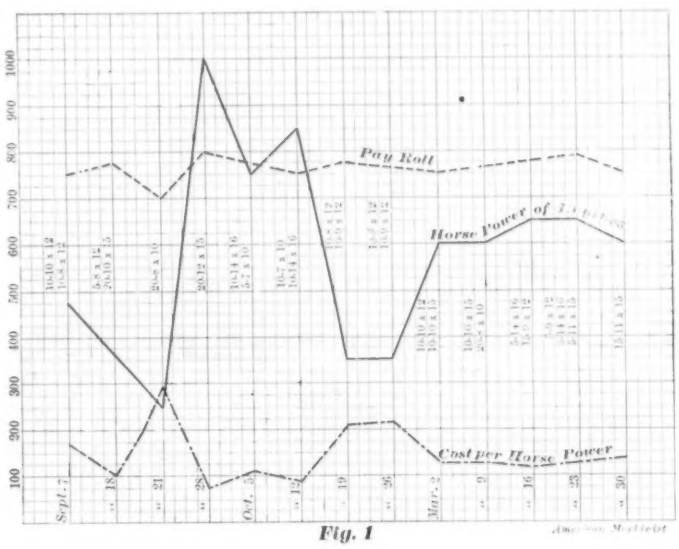


Fig. 1

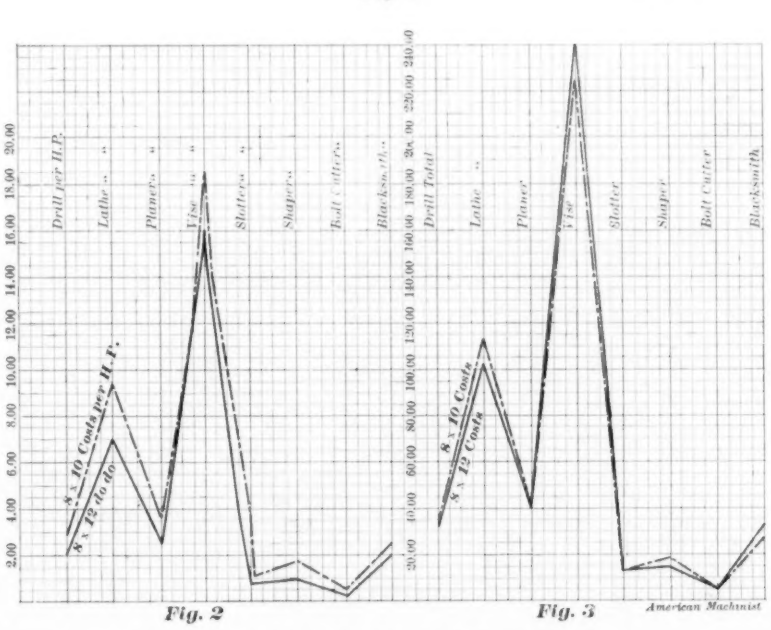


Fig. 2 *Fig. 3*

USES OF CROSS-SECTION PAPER.

It is strange how after your patterns are all right and your gages are made, and the core makers and molders have made, say, one hundred pieces from the same pattern they will leave a piece out of the core box, and before it is discovered by the machinist who is to finish the part 20 or 30 castings are made that will call for 10 or 20 per cent. more time to finish than if made in the right way, and it often does not occur by any carelessness of anybody. Still a change in the molding sand or mixture of irons in the cupola can produce a result calling for more time in the machine shop—by either having the castings so much harder than usual or with less shrinkage to them.

I do not wish to be understood as laying one of the ills that call for extra time in the machine shop to the foundry, as I know other departments come in for their share of the trouble, and I believe that the use of cross-section paper in plotting the costs in the foundry and the product in other departments is as valuable as in the machine shop.

I know from my own experience that I reduced the cost of labor in the foundry over $3 per ton of castings by this method, and it was not all molding either.

I will guarantee that if any shop will keep accurate records of the costs of each manipulation in each department, and use them as I have described, and be guided by the indications so pointed out, that they will double their profits if they are now making any, or make a good profit if they are now losing money. Try it and see.

The Patent Office Gazette of October 29th contains a number of patents with long claims. Francis H. Richards, of Hartford, Conn., occupies nineteen pages, with sixteen patents for an automatic weighing machine.

Crank Shafts of Single-Acting Engines.

The relative weakness of single-acting engine crank shafts was first brought to my notice about thirteen years ago when one of my friends, a very good engineer, was bitten by the high-speed mania, and must design a high-speed engine with results satisfactory neither to his customers nor to his own pocket. The attention I myself gave to the subject at the time convinced me of the necessity of specially stout shafts, and it was with these ideas that I recently wrote the AMERICAN MACHINIST on the subject. An English paper reprinted my letter, and I cut out the article and mailed it to an engineer who has a goodly number of high-speed single-acting engines under his charge. He thanks me for the cuttings, but complains that I might have selected a kinder and less appropriate time to send them, seeing that while my letter was in the post, he was busy taking out a bent crank shaft. As there are so many makers of single-acting engines, I do not think this item can be brought home to any one of them, so do not need to withhold it as it emphasizes so well what I had to say in my previous letter; and it is always so nice to be able to say, "I told you so." But it is not of weak shafts that I would now specially write, but of the reason why they are weak. They are weak not because the stresses in them have been particularly underrated, but because the nature of the stresses has been absolutely ignored. Single-acting engine makers have been full to repletion of the idea of stress being always in one direction, and I believe they have actually succeeded in persuading themselves that the stresses in every part of their engines are in one direction instead of, what is the truth, that the bending and torsional stresses in the crank shaft are reversed at every stroke. I spoke of Wöhler's law of stresses. This law it is that is ignored in the design of shafts. There is, perhaps, something of mathematics in this law of Wöhler's, but the kernel has been fairly well extracted and the main idea has been put in such form that the simplest of us can get at the teaching. But Wöhler's law is not a novel statement of observed fact by any means. Fairbairn, some forty years ago or more, pointed out the effects of reversed stresses, and all practice and experiment has since confirmed the truth of the basis of Wönler's law. Yet designers of steam engines, men who can cover acres with mathematical demonstrations of thermodynamical hypotheses, the truth of which cannot be known in the absence of knowledge of the action of steam in a cylinder, will refuse to give credence to experimentally determined facts in respect of structural material and the results follow which would follow a reduction of the diameter of the propeller shaft of the steamships "Paris" or "New York" by, say, 5 inches.

At the time the Forth Bridge was building, the engineer, B. Baker, carried out and published experiments on reversed stresses which were very conclusive as to their destructive effects.

I have as much contempt as anybody for the mathematical gymnastics which get plastered over certain subjects in engineering, especially when there is an absolute uncertainty as to the data. Thus in the thermo-

dynamics of the steam engine we know as yet absolutely nothing of the effects of rough or polished interior surfaces of the cylinder, we don't know altogether how the jacket acts, and at most have only some idea of generalities. But we do know with tolerable exactitude the pull and push on a crank, and we can correct the figures obtained from the indicator card by proper allowances for inertia of moving parts and obtain the crank-pin pressures at all points.

There is also a large fund of fact in shape of existing dimensions of satisfactory engines, and yet in face of all this the new type of single-acting engine has been built up during the period I have named entirely on a system of break and try again, and in one size of engine with which I am acquainted the crank shaft has now doubled its strength, and very possibly this may be found insufficient.

Does it not seem late in the century for mechanical engineers to refuse credence in the observations on reversed stresses? Everything points to the soundness of Wöhler's views, and if any special part of a machine seems to show special perversity in breakage, it may perhaps be discovered that the stresses in it are such as properly demand increased material. It certainly appears more than probable that the most successful designers will be those who have a proper appreciation of these points. My own experience at present in crank shafts, so far as constructional work goes, is confined to shafts of comparatively small strength and low speed, but where possible they are made to have constant pressure in one direction only—in pumps by the use of plungers to divide the duty upon both strokes, or by balance weights which act upon the crosshead, not through the crank.

Where machinery, such as pumps, is balanced through the wheels on the crank shaft it is usually overlooked that this implies a reversed stress in the crank, whereas the object of balancing should be to relieve the crank pin of part of its load and also of stress reversals, and I am confident that by following out work on the lines that Wöhler's law would indicate to be economical, we may save material as well as secure smoother and better working and freedom from breakdown.

W. H. BOOTH.

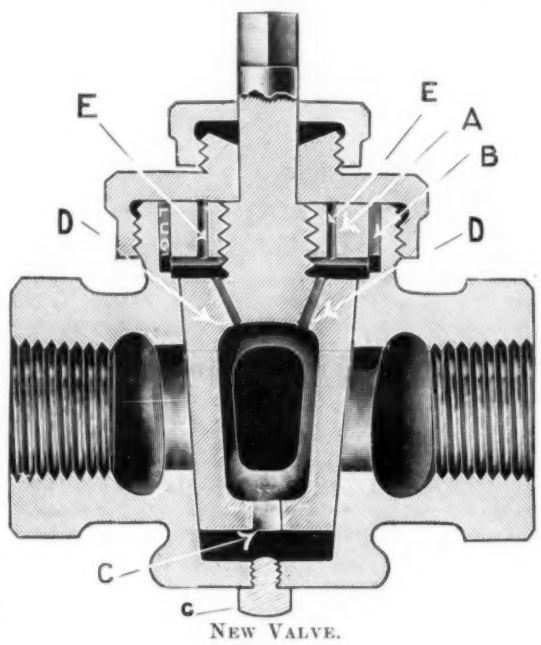
New Straightway Valve.

A new straightway valve that possesses some novel features of interest is shown by the accompanying sectional engraving.

As will be perceived, the valve resembles the familiar plug valve, but it is so arranged that when it is closed it is at the same time forced firmly to its seat, while when it is to be opened, the first effect of the movement to open it is to relieve the force which holds it to its seat, and thus not only enable it to be very easily opened, but also preventing scored seats and leaks.

This result is secured by means of the nut—through which the stem passes and is threaded as shown. The nut is prevented from turning with the stem, but can move a short distance vertically. Supposing the valve to be open the nut will be in the lower part of the chamber in which it is placed and the valve will be free to be easily moved. A quarter of a turn in the direction for closing it causes the nut to rise and take a bearing on the upper surface of the chamber and the only effect of further effort to turn the stem in that direction is to force the valve more firmly to its seat. A very slight motion in the other direction immediately releases the nut and the valve turns easily, being arrested at its proper open position by the seating of the nut at the other end of its travel.

Provision is made for the usual packing around the stem, though it is not found important usually to do any packing, and the plug is made of such a taper that it readily releases itself when turned. This valve has proven in service to give excellent results both for moderate and very high pressures and in cases where it is opened and closed a great many times during the day as well as where it is very infrequently opened. In one case, we are informed, it outlasted 12 valves of the ordinary pattern in a position where it was opened automatically by the action of the machine which it was used in the operation of. The valve is manufactured by the Homestead Mfg. Co., Homestead, Pa.



NEW VALVE.

Broaching Machine.

The accompanying engraving is of a broaching machine, especially designed to broach work upon the principles set forth in articles previously published in these columns, and which have proven so successful in practice, the principal feature being that the broach is pulled through the work instead of being pushed through, and can therefore be as long as may be required to finish the cut at a single operation, usually, and as the broach is in tension instead of compression when at work, many of the difficulties of ordinary broaching are entirely avoided.

The machine is simple in construction, its essential parts being a steel screw fitted with a bronze nut, which nut has a gear wheel (or in some cases a worm wheel) keyed to it. At either side of the screw and in the same plane are two bars which receive the thrust; none of the strain passing through the bed or base of the machine.

The work to be broached is placed in any suitable fixture, the entering end of the broach being passed through the previously drilled hole, and secured to the crosshead, which is drawn back by the screw, the work being held upon the face of the heavy plate at the right. The machine was first designed for use in bicycle manufacturing, and Fig. 2 gives some of the forms of holes made by it, at a single operation, in cranks.

One of the special features of the machine is in the broaches themselves, and the principle of their construction is shown in Fig. 3, where the successive sections of a broach for making a square hole, such as those required in tool-post wrenches, etc., are shown. For such work a round hole is first drilled, and the entering end of the broach is also round, as shown at *A*, Fig. 3. This shape gradually changes to *B*, one side being kept cylindrical and smooth to act as a guide. From that point the shape gradually changes to *C*, the alternate side being smooth, and using the finished side of the hole as a guide, there being in every case a smooth guiding face opposite the cutting edge, effectually preventing digging, and producing very accurate results. The length of the broaches depends on the depth of the hole to be broached, and is always sufficient to insure long life and easy cutting; and, made in this way, soft spots, blow holes, etc., in the work do not affect the position or size of the finished hole, and the breaking of broaches due to crowding of the broach is impossible. The broaches can be of almost any desired cross-section, and the larger ones usually have inserted teeth, which in case of breakage may be readily replaced.

The countershaft is arranged to give a quick return of the screw, the working stroke of which, in the machine shown, is 22 inches. The base forms a cabinet in which broaches and fixtures can be kept if desired. It is made by John T. Burr & Son, Kent avenue and South Sixth street, Brooklyn, N. Y.

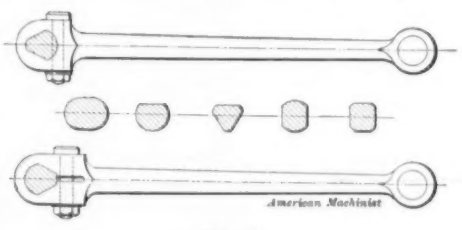


Fig. 2.

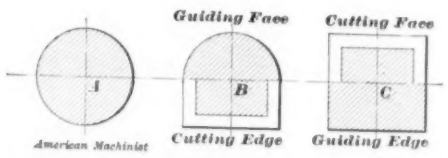
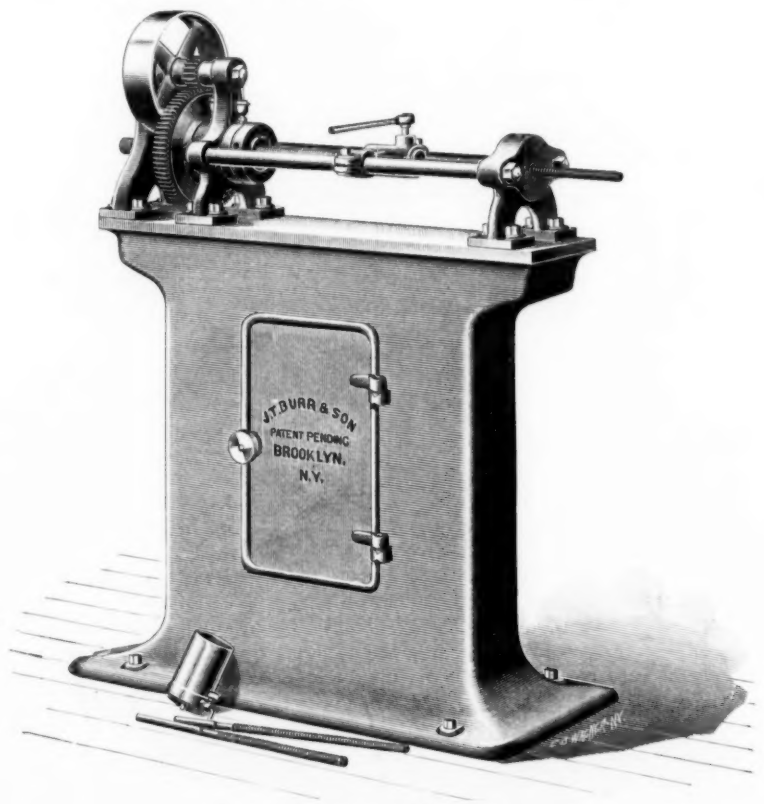


Fig. 3.



BROACHING MACHINE.

Machine Tool Economics.

On the inside cover of a catalog issued in 1886 by the San Francisco Tool Company, is printed the following:

"The true epic of our time is not 'Arms' and the man, but 'Tools' and the man; an infinitely wider kind of epic."—CARLYLE.

It is roughly estimated that each full workman in a machine shop requires 100 square feet of floor room, $1,000 worth of tools, and costs for wages and expense $1,500 a year.

Supposing the interest on investment and depreciation of tools to be 10 per cent. a year, then the cost of a year's work would be, for wages and expense, $1,400; for tools, $100.

To repay this, $1,500 is the product of the workman's labor, and that depends upon the facilities he has for doing work; in other words, it depends upon the $100 for tools, and not upon the $1,400 for wages and expense.

If, by doubling the investment in tools, 25 per cent. could be added to the efficiency, the added expense would be $100 a year, and the gain in wages and expense $350 a year, or a saving of $250 for each workman.

This is not speculation, but fact, and accounts for the success of well-equipped shops in all lines of regular manufacture.

It is not tool investment that makes up the cost of work; on the contrary, it is the want of tools.

American Machinery in Siam.

We have a letter from Mr. J. Barrett, our American Minister to Siam, in which he says:

"There is a considerable machinery business done in Siam, which is on the increase but the major portion of machinery imports are from England and Germany. The chief branches concerned are rice milling and steamboat building. Rice mills are growing more numerous, and small steamers and launches are in greater demand every year.

"I am one of those who believe in energetic and persistent effort being made by American exporters of all classes to get a fair share of this developing commerce of Eastern Asia, which finds its outlet in the vast coast that reaches from Vladivostock and Hakodate to Singapore and Batavia. If they use extraordinary endeavor, they can win—if not England and Germany will beat them out. I am doing all in my power, though the field in Siam is very limited, compared to that of Japan and China, and I am pleased to see that such a paper as the AMERICAN MACHINIST is striving to extend our markets."

Sulphur in the Facing of Molds.

A manufacturing concern writes us as follows:

"We are making a great many castings which have teeth running lengthwise, a section of which is something like a saw tooth. The castings are cone shaped, with the teeth running lengthwise of the cone, so that a section at right angles to the axis of the cone resembles a circular saw.

"We make these castings of very hard iron, but it is not practicable to cast them in chills. We are troubled by a thin scale of softer iron on the surface and edges of the teeth, which we prefer to have perfectly hard. It may not be quite right to call this a scale, as it is more correctly a thin layer of softer iron merging into the hard iron below. It occurs to us that this soft surface may be owing to the sea coal facing which we mix with the sand in the proportions of about 1 to 12, and that the iron may take up the carbon in the facing. We would like to inquire whether you can suggest any other form of facing which will give smooth, sharp castings and which would be mixed with the sand, as we cannot apply any

facing to the teeth in the mold, and which will give a *hard* surface.'

We referred the matter to Mr. L. C. Jewett, who writes as follows:

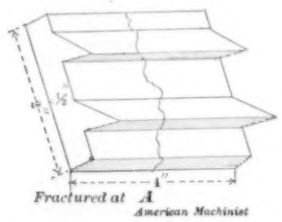
"These people have certainly met with different experience from any I have chanced to meet, inasmuch as a soft skin on cast-iron I never met, but the opposite—a hard skin or scale, and softer as you go in toward center of casting.

"Sea coal and charcoal dust facing we have always supposed produced a hard scale, the surface of the hot iron being carbonized to a greater degree from absorbing carbon from the sea coal and charcoal that the mold had been treated with.

"But, however, if I was to try the experiment of making those teeth harder, I would put some pulverized sulphur in the facing sand, say, 1 sulphur to 20, or 1 sulphur to 16. We know that if iron absorbs sulphur from the fuel while being melted it hardens the iron, and it would follow very naturally that if iron absorbed sulphur, from, no matter what, or where, it would become harder in consequence. I never heard of this being done, but I will do it next week to see what the effect is. I will mix up various kinds of facing, of different proportions of sulphur, and pour several pieces, same pattern, same ladle of iron, put in sulphur in different proportions, and send you the results By breaking casting we can see which is hardest."

Later Mr. Jewett writes:

I tried the experiments as mentioned in my last letter with the following results



(from a pattern as per sketch). Five castings were made.

No. 1 in ordinary clear sand.

No. 2 in facing sand, 1 coal to 12 sand, with sulphur dusted on the mold.

No. 3 in facing sand, 1 to 12, and then introduced 1 sulphur to 10 of the facing.

No. 4 in facing sand, 1 to 12, and then introduced 1 sulphur to 15 of the facing.

No. 5 in facing sand, 1 to 12, and then introduced 1 sulphur to 20 of the facing.

No. 1 was as any ordinary casting, and made for purposes of comparison only.

No. 2 had a fine white skin around or on the surface—just perceptible.

No. 3 had a white skin very much more distinct, in fact, at points it was $\frac{1}{32}$ inch deep and resisted the file.

No. 4 had a white skin less distinct, but filed hard at points.

No. 5 had a white skin still less distinct, but filed hard at points.

Every one that had the sulphur incorporated in the facing sand was pitted like fine pock marks on the surface, but the evidence was conclusive that it would make the skin of a casting harder.

The iron that this experiment was tried with was the best in the world to try it with, as it was the softest grade that is melted for foundry purposes, being largely from pig made from the black band ores of Ohio. No. 1 33 per cent. Mary iron. No. 2 33 per cent. Alleghany. No. 3 33 per cent. Anniston, Ala. If harder irons were used, say, of No. 2 and No. 3 anthracite irons, with 33 per cent. of No. 3 charcoal iron, there would be a much greater change in that portion of the iron that came in contact with the sulphur facing. How little would be required to produce the desired result, would have to be learned by experiment, and the less sulphur used the smoother would the surface of casting be.

Sweden has a curiosity in the shape of a small steamer which, by an ingenious arrangement of railway track and wheels, is able to traverse a short stretch of land separating two lakes, using no other power than that of its own engines.

Different Ideas of Shop Management—Contracting Work.

Among engineers who honestly believe that all men are equally entitled to live and earn the necessities of life, a problem concerning shop practice calling for more thought and study than all the jigs, chucks and "easy ways," is the proper distribution of labor and the establishing of a price for it that will prevent discontent among the workmen and at the same time promote an increase of dividends to the employer.

A man with years of experience as manager of a large plant, in conversation on this subject, informed me that he had a man in his employ now getting $1.50 per day, who at one time earned $4 for the same hours. "It is an easy matter," he explained, "I just laid him off indefinitely. He had a family and could not leave the town. Time and circumstances eventually forced him to come to me begging for employment at any price, and I hired him on my own terms, and I get more work out of him now than I did before. You see, his independence is all gone. Oh, that is the way to work it every time."

As this man employs several hundred men, it is easy to compute the profits in his business. Then I saw a Corliss engine built by his company, and knew of the many hours and days charged against it for repairs by the purchasers on account of bad workmanship and lack of knowledge on the part of the builder. Later I discovered that he had built only two of this type, and my line of reasoning was thus: He had made a profit on this engine he sold; but suppose he had expended a little more for first-class workmanship, would it not have been possible for him to have sold ten such engines during the past three or four years on their merits, and thus made his company a greater profit, and at the same time had contentment among his men? I tried to induce him to see things differently, but it was labor wasted. He could only grasp the one idea that a laborer getting more than $1.10 for ten hours work was a thief and a robber, and the man that hired him an idiot. He did not believe in tool rooms, and from his conversation one would be led to believe that jigs and templates grew on trees.

What constitutes a day's work, has often been asked me, and I asked this man for his opinion. He answered, "There is no limit; you can scare them into anything." "But, suppose," I asked, "the man has sense enough to——" "Oh, you don't want to hire a man with sense," he replied. And I pondered over the problem: How are you going to get sensible work out of a senseless man? This is no picture of fancy, but one instance of many in shop management. This man in ignorance was but a plane higher than the brute creation, consequently could not abide anything tending to elevate himself or the creatures under him. He built a machine to run by steam and called it a Corliss engine, because it "looked" like the thing others called a Corliss, but not because it "worked" like a Corliss. The builder of the one he copied from probably sold his engine at a valuation based on its merits. He sold his "by the pound," because that was the way it came from the cupola.

Another example, and a living one, too, has come to my notice. A corporation needed a foreman over a department, and the man they engaged was informed by the manager that the employes were getting wages already too low, and he desired the introduction of methods of more modern practice whereby the product would be increased and a reason thus shown for granting an increase in the wages of the men. Now, I have no doubt but there are managers and superintendents who will swear that this is the rankest heresy. But I have also noted the result and must say that this manager is right in several ways. His product is better in appearance and in action, and he is talking "superior workmanship" over his competitors, and he also is getting more business at fair prices. He is also getting greater profits on account of the output being greater, and the employes will shortly get a "raise" on account of the "good times" as the newspapers will say; but is it not really on account of this man who has been placed in charge of the moneyed affairs of this company being a man of education, reason and intelligence? I also asked this man, "What constitutes a day's work?" and he quickly answered, "There is no such thing as a 'day's work.' It all depends on the piece, its nature and the methods for doing work, which vary according to the ingenuity and reasoning powers of the operator and his superiors. The greater their intelligence and the more it is cultivated, the less the time required for doing work and the greater will be the profit and the easier it will be for selling manufactured goods without gaining the reputation for 'shoddy' manufacture."

This man of intelligence had gone a step beyond the other one, whose scheme is to go about disguised as a "bogie man" and frighten his men into working. While ignorance and egotism are in the mire searching for fresh clubs to batter out the brains of weaker labor, education and reason have easily and satisfactorily shown that the relation between employer and employe is the same as that existing between two business men in their daily transactions of barter and trade. In the latter instance two parties come together with marketable commodities to dispose of, each having a money valuation fixed wholly by the amount of cultivation and energy he has devoted to its development, and each is an earner of dividends according to his capacity for marketing his goods, regardless of the terms, "piece work," "premium sharing," or "profit sharing," while the man who builds the imitation Corliss engine practices only a system that is a relic of a past age of the egotism of a few and the ignorance and superstition of the masses. "Don't educate the boys, but put them at the machines and have the fathers carry the dinners, and when the boys' wages will not support the family, the father will come in and work for the boys' wages, and lo, see our profits." And in the end what is the result? The salesman, bidding for contracts in competition, puts in his figures and wires to the firm, "we are the lowest bidders." All knowledge of workmanship and its lasting value is lost in the one great idea of "being cheap." They buy the cheapest materials, hire the cheapest labor and go on the market with the "cheapest" shoddy goods.

Another simple method of trying to make shop profits is to put a price on each machine regardless of the abilities of the man who runs it. If the better man knows that his greater daily output will not bring him 1 cent more in wages than what his neighbor gets who does 20 per cent. less, he feels the injustice of the system, and naturally lowers his work, and if he allows himself to remain long in this state he eventually becomes a shiftless workman as well, and discontent, that breeder of many evils, makes the shop earnings grow small. The price should be fixed on the ability of the man, and not be gaged by the size of the machine.

It is not desirable, I think, from the standpoint of either the workman or the employer, that the former should come to be regarded as one of the permanent fixtures of the place, without an idea beyond working at his employer's price, drawing his money on Saturday nights, and feeling grateful for being allowed to work at all. Such workmen become petrified, and their regard for their employers does not keep the works going in times of adversity.

A price or premium worker who has had dealings with his employers under contracts, and on terms of substantial equality, can throw himself into the market at a valuation based on a confidence born of experience, and he soon becomes a living figure in some other concern, or starts a successful enterprise of his own. All because his daily work has been of such a character that he has been taught to reason and think for himself—to study improved methods.

A friend suggests against this argument that it will tend to prevent the purchasing of homes on the part of workingmen, and thus destroy the permanency of residence of mechanics, and I say, not necessarily, unless carried to extremes. Let the mechanic take another lesson from the commercial man coming to a city to engage in business. He does not rush out to purchase a "home" as soon as he gets the store windows cleaned, and the goods on the shelves, but waits until his business warrants such an investment, and then when he does invest, it is not within 200 yards of his store, for he knows the lease will expire some day, and he will have to move. He notes carefully the growth of the city, and invests his spare cash in the direction where "homes" are going to grow in value financially as well as sentimentally; then, when he chooses in after years to move to other climes, or his business depreciates to such an extent as to cause him to locate elsewhere, he can realize on his property without financial loss.

There was a time when I did not believe in contract or price between employer and workman, but experience, that best of all teachers, has shown that it is the contract or price-paid methods that educate and elevate mechanics, bringing themselves and employers closer together as business men in commercial enterprises.

"THE OLD MAN."

Aluminum Solders.*

BY JOSEPH RICHARDS.

The ordinary solders will not attach to aluminum, and it has therefore been necessary to devise others for the purpose. M. Christofle, of Paris, discovered that aluminum is wetted by, and can therefore be soldered with either pure zinc or pure tin. But that is only the beginning of trouble. These metals hold firmly to the aluminum, but the zinc seam is brittle, will not stand working and discolors badly and quickly, and the tin seam disintegrates and falls to pieces in a few weeks. Some alloys of tin and aluminum decompose spontaneously by the action of the air. This is particularly true where the proportion of aluminum is small or far below 10 per cent. A bar $\frac{1}{16}$ inch thick has been known to decompose in three weeks. Tin containing 0.5 per cent. of aluminum was rolled by a maker of tinfoil into a sheet .001 inch thick, and although it rolled beautifully, in two hours it was as brittle as glass. A long list of metallic mixtures were tried for aluminum soldering without success, and at length the Societé d'Encouragement offered a prize for a solution of the problem, awarding it to Mourey, a Parisian goldsmith. His best solders were alloys of aluminum and zinc, with a little copper for toughness. The chief objection to these solders is their high melting point, zinc, which melts at incipient red heat, being the easiest of fusion. These high melting alloys can be used for brazing or blow-pipe work, and a little silver will improve them, but they are not convenient for the soldering iron. It is claimed that with silver chloride for a flux aluminum can be soldered in the ordinary way with common tin solder, but the method is not satisfactory in practice, and the flux is too expensive.

The ascertained requisites for an aluminum solder are:

(1) It must wet the aluminum and adhere firmly.

(2) It must not disintegrate after exposure to the air.

(3) It must be as malleable and as strong as aluminum.

(4) It must have a low melting point, so as to be easily worked with a soldering iron.

(5) It must have the same color as aluminum, and not change color.

(6) It must be cheap enough for general use.

After two years of experimenting it was found that an alloy of zinc and tin in certain proportions, with a little aluminum and

* Condensed from the Journal of the Franklin Institute by and for the AMERICAN MACHINIST.

some phosphorus, realized almost every desideratum. The alloy used for some time was composed of :

	Parts.
Aluminum	1
Ten per cent. phosphorus-tin	1
Zinc	8
Tin	32

It was found that on remelting this solder a more fusible alloy liquated away from it. This more fusible portion was also found to solder better than the original mixture. Its composition was found to be very close to that expressed by the formula $S\ n_4\ Z\ n_2$, and the solder now used by the writer is made to correspond closely to this formula. The ingredients are used in the proportions 1, 1, 11, 29, instead of 1, 1, 8, 32, as previously. The composition of the several alloys may be thus compared:

	Original Solder.	Found in the Liquated Alloy.	The Formula $S\ n_4\ Z\ n_2$ Calls for	Solder, as Now Made, Contains
Aluminum	2.38			2.38 } Zinc + Aluminum, 28.57
Zinc	19.04		29.3	26.19 } per cent.
Tin	78.34	71 65	70.7	71.19
Phosphorus	0.24	.....	.....	0.24

As practical usefulness is a fair criterion of the value of an invention, the writer would say that this solder has come largely into use in Germany, Switzerland, England and our own country.

The demand for aluminum solder is limited. About four tons per day of aluminum are now produced in the whole world, and fully 75 per cent. of this is used up in the steel industry and in the various alloys. Of the remaining 25 per cent., which is rolled, spun, cast or stamped into pure aluminum articles, probably not 10 per cent. is in such shape as to require soldering. Assuming 200 pounds per day of aluminum to be soldered, a daily supply of a very few pounds would do the work. In the next ten years the daily or annual product of aluminum may be increased tenfold, and the demand for a good solder, we may believe, will increase accordingly.

Drill Press With Revolving Table.

We illustrate herewith a drill press made by J. E. Snyder, of Worcester, Mass., and which is the same as the regular machine made by that maker, except that the table is arranged to be revolved by an extra countershaft at the base, and suitable gearing as shown. This enables work to be chucked true upon the table, and better fits it for boring pulleys and similar work.

The machine shown is called the 25-inch, and has a distance from center of table to post of 12⅞ inches; greatest distance from spindle to table, 33½ inches; automatic feed, 23 inches; this being obtained by movement of arm upon the column, instead of by movement of sleeve through the arm, and thus keeping the point of support always at the same distance from the drill point or cutter.

Bicycle Tools—VII.

STEEL RIMS.

The list of operations on the steel rim previously given was not so complete as it should have been to fully represent the manufacture; the treatment from the coiled steel strip to the finished rim includes the following steps: Cutting to length with foot-driven square shear; first, pass through rolls; second, pass through second rolls; third, pass through drawing shoe and rolls, this third pass being a compound operation, part drawing and part rolling, the two processes being effected simultaneously; fourth, pass through third-pass rolls (after brazing), and a fifth and a sixth pass through differing rolls to complete the hooking edges. For these rolling operations five rolling machines are used, of which the last three are of the same pattern fitted with different rolls, while the third machine has also a hand cam actuated breaker, or shaping attachment, which is hooked down to form a drawing die after the rolls bite the stock and imitate hand operations in polishing with strips of emery cloth.

The first of the rolling machines which edges up the first bend for the hem on each side of the rim strip was shown in Fig. 47. Photographs of the rolls used for the six-

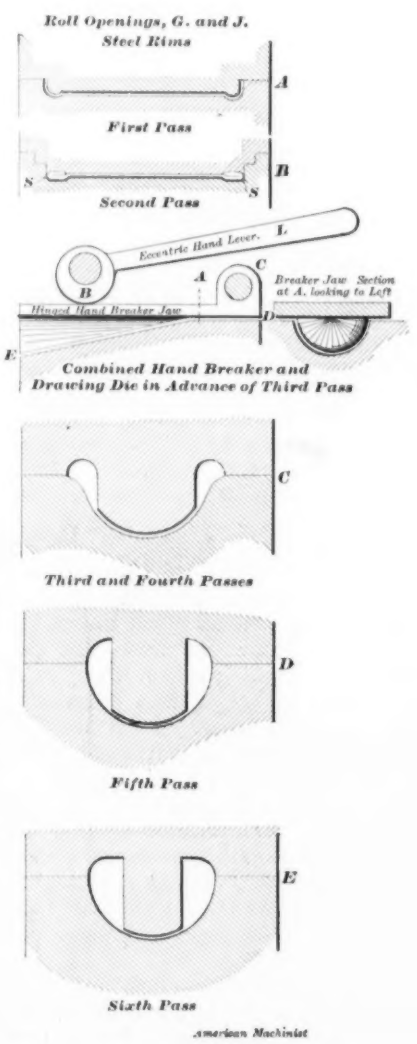
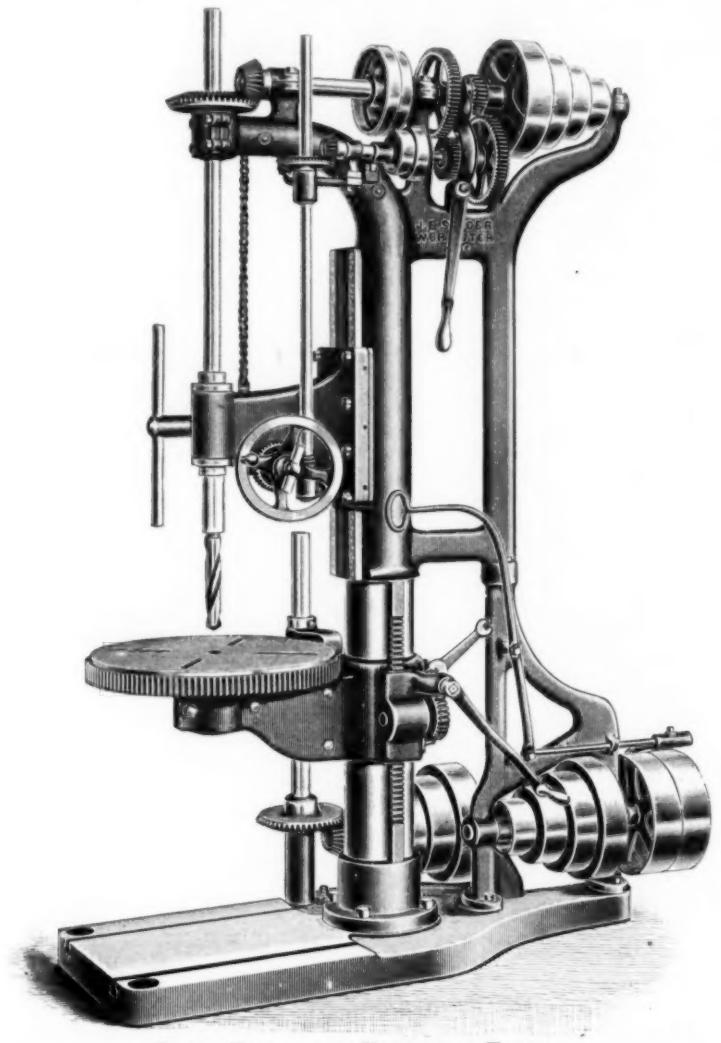


Fig. 48.



Drill Press with Revolving Table.

or successive shapes assumed by the stock. While it seems a very simple thing to form thin, flat stock into intricate shapes by means of rolls, the novice and the expert alike find many trials needful to shape a set of forming rolls so that they will bring the stock to the desired form. The sections here given are the result of many trial efforts, and furnish useful hints for similar processes.

The first pass rolls, *A*, Fig. 48, are used in the machine shown in Fig. 47 (last issue) and leave the rim strip flat in the middle and edged up on each side for the hem.

Fig. 49 shows the machine in which the second pass rolls *B*, Fig. 48, are used. This is a small machine, strongly driven from a pinion shaft crossing under the table in front of the machine to a spur gear on the lower roll at the left-hand end; the upper roll is driven by equal pinions from the right-hand end of the lower roll. There is a top roll adjustment by lining up under the boxes. The lever and bell crank arrangement between the legs is not used for adjusting the lower roll. The flat strip enters readily, the curving corners *S S*, Fig. 48 *B*, giving the upright edges the initial inward "coax" or inclination which insures the turning down of the folds of the hems. This machine is as simple as a pair of geared power-driven rolls can be made. The notable point is the very small coaxing curve at *S S*. Without this curve, small as it is, the fold would not be made, as there would be nothing to give the hem flange its first inward impulse.

Fig. 50 is a general rear view of the large rim-grooving, forming and re-rolling machine; Fig. 51 is a front view of the same, with the workman in the act of putting in a brazed rim for re-rolling. Fig. 53 shows the front of the machine with the "breaker and drawing die," sketched in Fig. 48, in full view.

This is a very complicated rolling machine, and serves to put the rim in trough form, at the same time rolling up the rim to any diameter, and also serves for re-rolling the rims after brazing. Gormully & Jeffrey use three of these machines, which they built themselves, and the "Waverly" (of Indianapolis) uses a machine of very similar general appearance. The four figures, 50, 51, 52 and 53 clearly illustrate the peculiari-

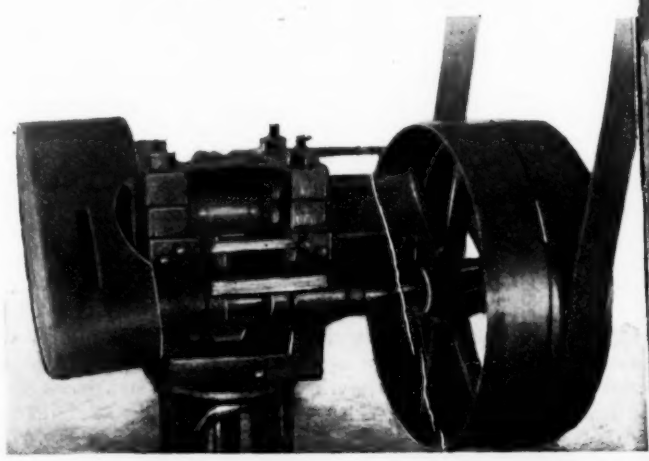


Fig. 49.

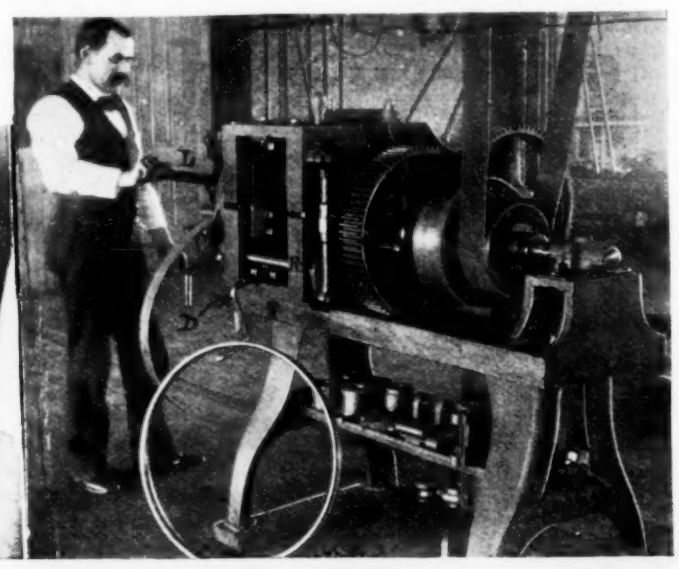


Fig. 50.

Making Steel Rims.

ties of this machine when studied with the aid of the following description. The machine is driven by a 2-step cone (Fig. 50) with a double back geared reduction to the under roll spindle, and an equal pinion drive, at the cone end of the housing, from the lower roll shaft to the upper roll shaft. The housing is made in an upper and under part, carrying the upper and under roll spindles respectively, and these two parts of the housing are jointed together at the rear side of the housing (Fig. 51), the shaft which carries the first reducing spur gear and the second reducing pinion being made to serve as the housing joint pin. The deep rolls, *C*, *D* and *E*, Fig. 48, would require a great deal of moving if they were separated to admit a brazed tire in the usual manner; and the curvature rolls, which give the rim its proper diameter, would also require an adjustment every time a brazed rim was rolled; to avoid all this the housing is made in two parts, one carrying the top roll spindle and outside curvature roll, and the other carrying the inside roll spindle and inside curvature roll, as specified.

The top and bottom parts of the housing are held together by the double-cranked rock shaft *R*, Fig. 50. This rocker passes through the housing uprights, and has a crank on each end; rods from the wrists of these two cranks pass upward and take hold of wrists fixed in the upper half of the housing; when the housings are closed together the rocker cranks stand on their low center, and so give the most rigid closure of the upper and lower housing parts; the housing has horns, *H*, in front, which carry outboard roll spindle bearings, as shown in Figs. 51, 52, 53. These horns are tied together by the hinged eye bolt *C*, Figs. 52, 53, which is used when rolling unbrazed, open rims. When brazed rims are to be operated upon, the tie bolt *C* is turned up out of the way, as shown in Fig. 51. The hand crank *D* fits the outer ends of bevel pinion carrying shafts, which operate adjusting shafts and screws, concealed by the housings, which determine the positions of the curvature rolls and the hand-breaking and drawing fixture *O*, supported on the segment-footed bracket *M* in front of the housings. The mechanism of the hand breaker and drawing die is sketched in Fig. 48; were a flat hemmed rim blank presented to the deep rolls *C*, Fig. 48, which make the third and fourth passes, the rolls would not bite it, hence the introduction of the hand breaker, consisting of a hinged jaw, Fig. 48, having on its under side a half-cone worked out of the solid, and fitting a corresponding cavity in the block below, where a thickness of rim stock is interposed between the two. When the hemmed flat rim strip is slipped into the "breaker" at *D*, Fig. 48, it can move freely toward the deep rolls *C*, Fig. 48, until it meets the apex of the half cone at *A*; then by working the hand lever so as to give successive nips by means of the eccentric *B*, and at the same time shoving the strip towards *E* with the left hand, the leading end of the strip is very easily and quickly formed into a trough of sufficient depth to be readily grasped by the rolls; as soon as the rolls take the rim strip out of the left hand of the operator, he, while holding the eccentric lever *L*, Fig. 53, hard down with his right hand, uses his left hand to latch the lever and breaker jaw together with the latch *P*, Fig. 53, and the rolls continue to draw the strip along between the half cone on the bottom of the breaker jaw and its correspondingly shaped seat, which together now form a stationary drawing die. *I*, *I*, Fig. 53, adjust the curvature rolls, and *J* adjusts the breaker bracket vertically.

After the third pass the rim, now in the form of a circle, with hemmed edges and a plain trough section, goes first to a man who cuts to length, using a steel tape and marking across the end of the tape with a slate pencil; in Fig. 54 the end of the steel tape is shown between the thumb and finger of the right hand of the workman. The Plymouth shops measure the rim with a blacksmith's tire wheel, and the St. Nicholas measures the rim from a circumscribing square, and Gormully & Jeffery measure it with a steel tape, which goes to show that the same job may be done in different ways in different shops.

After marking, the rim is cut to length on a foot press, as shown in Fig. 55, using a round lower die to fit the hollow of the rim, and hollow top shear to fit the inside, and next goes to the joint filer, who carefully, and with five or six different files, scarfs the two ends to lap about half an inch.

Hugh Dolnar.

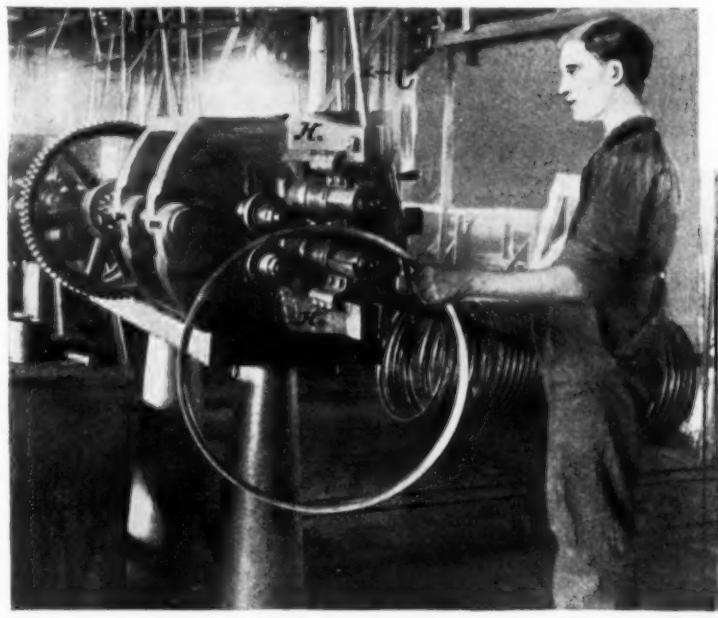


Fig. 51.

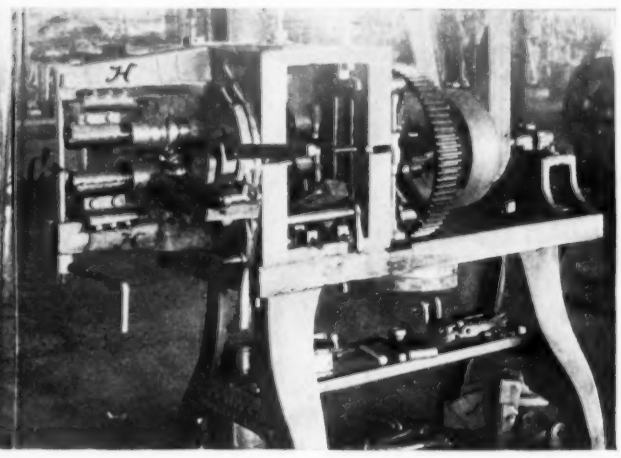


Fig. 52.

Steel Rim Rolls.

Misplaced Confidence.

A short time ago we put our faith in an electrical journal to the extent of republishing an item about the probable substitution of electric for steam locomotives, and now comes the *Railroad Gazette*, and, regarding that item, remarks as follows:

"One of the electrical journals says that the Grand Trunk is about to adopt the electric locomotive for the tunnel service under the Detroit River at Port Huron. We are informed by that journal that the locomotives now working the tunnel weigh 95 tons, and they weigh in working order 195,000 pounds, all on the drivers. The tunnel is not lined with steel, but with cast-iron. The backing of the lining is not asphalt, but Portland cement grout. No injurious effect has been produced upon this lining by the steam or heat from the locomotives. And finally the main proposition is not true; the Grand Trunk is not about to adopt electric locomotives for this service."

In the West and Northwest, especially in the lumber trade, great complaint is made of the scarcity of labor, meaning not work but workers. The employment offices are full of orders for men and they cannot fill them. One agent in Minneapolis wants 2,500 men that he cannot get. Labor in Michigan is very scarce and lumbermen are paying the fares of men for long distances to get them. The Chicago Canal contractors are scouring the country for more laborers. The government is in great need of men to carry on the work on the Mississippi levees, and a number of railroads, particularly in Wisconsin, are advertising for men.

A new form of pipe joint for very high pressures has been invented by Mr. A. J. Rossi. It consists in making an annular groove of rectangular section in the internal thread or coupling, cutting away something like two or three threads. Into this annular groove a lead ring is placed, and one or two holes are tapped into the groove from the outside. Screws placed in these holes may then be forced down into the lead, causing it to flow, and making it fill tight. Joints made in this way are claimed to stand pressures almost impossible to hold with any other form of joint. Some trouble, it seems to us, might be expected from the expan sion and contraction of the lead under changes of temperature.

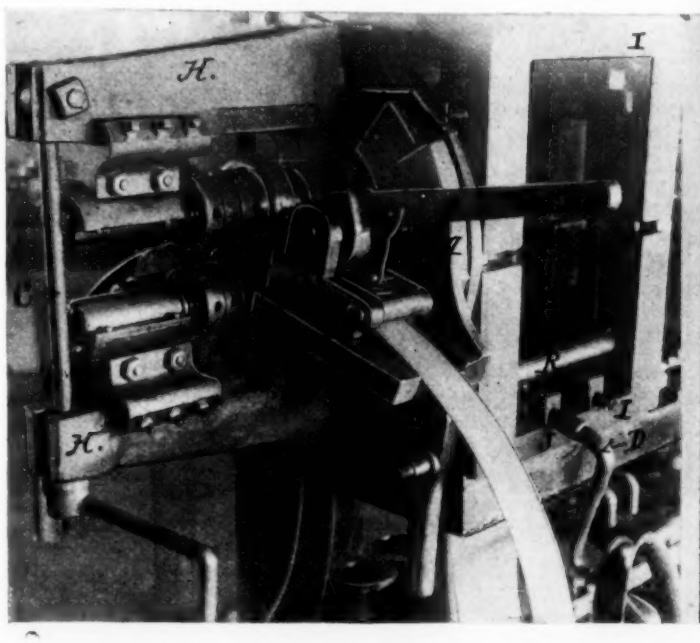


Fig. 53.

Fig. 54.

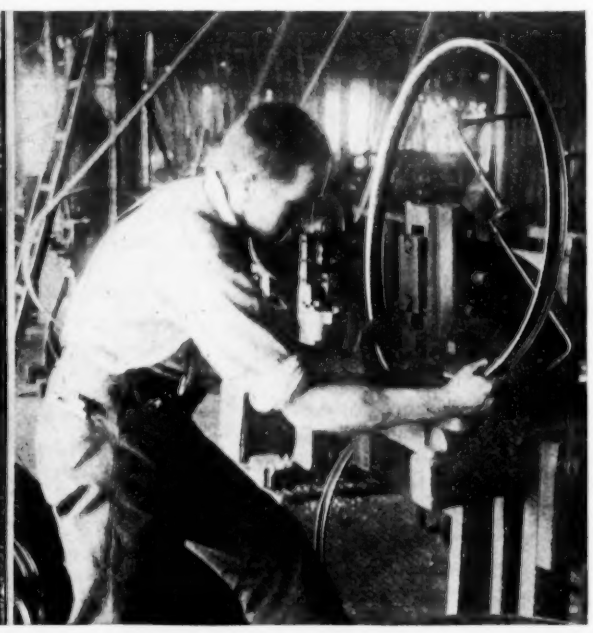


Fig. 55.

Steel Rim Making.

LETTERS FROM PRACTICAL MEN.

A Job of Grinding.

Editor American Machinist:

We used to do a deal of saw-mill work at the Marine Works. Most of the time the lumbermen would bring the work to the shop, for the idea of paying us for the time spent going ten or twenty miles up country did not agree with their idea of doing business; and I have met men who were not lumbermen, who thought the same thing.

Sometimes the work was such that they were obliged to have us go, and in some cases they would bring in the measures, and we would work to them, and then when the work was put in place there would be fun. The boss was an old hand at the works and knew just what was wanted by a "scant" inch, or an inch and a quarter "full," and the work would generally go together all right.

One day a lumberman from "up country" brought in a big crown gear to be bored out to fit the main shaft in the mill, the old one had worn out, and he had taken it off and fixed it up, and had one cast from it. He brought in a stick, cut to the diameter of the shaft, to bore the gear to, also a wooden pattern of a key for the same. He wanted us to do the work and go up and put it in and race the teeth off, after it was in place.

Well, we took the job with some misgivings, and it was given out to me with the caution that what I did not get right in the shop I would have to make right after I got up country with the job. I knew what that meant, so I went ahead and did the best I could, bored the gear a little strong, and left the key a little full so it would take up any stock in the boring. I finished up the job on Wednesday night, and the next morning took it on the big lumber gear and went up to the mill. It weighed nearly a ton, and we had a 2-ton chain hoist to handle it with, and we swung it into place without much trouble; it started on all right, and went on about 4 feet (about half way to its place) and then it stuck fast; the shaft was tapered nearly a thirty-second of an inch, and that means a good deal on a 5-inch hole. We had some bastard files with us, and we went for the shaft with them, and put in several hours of the hardest kind of work, then an inspiration seized me; the mill being so far away from anywhere; a supply of oil, belting, emery, etc., was carried in stock, I found a can of coarse emery in the store room, and at once I saw a way to get home Saturday night.

We put a stick of timber through the gear with the ends resting on the wall of the mill, then Joe slushed the shaft with emery and oil, and we started up the wheel, we put the chain hoist on to hold the gear from going on too quick, and a rope fall to coax it on with; the rig worked fine, and long before six we had that gear in place, the last 2 inches went hard, and as the gear struck the shoulder the water wheel brought up all standing. The slot in the gear and the shaft did not line, but we left the key to be put in if it ever did start, raced off the gear, and came home.

The boss smiled a smile when I made my report, but said nothing, but the next week I found an extra quarter put on to my wages that spoke volumes.

A. P. PRESS.

Brazing.

Editor American Machinist:

In your issue of October 24th, the article describing method of brazing is out of date.

Having brazed bicycle frames, etc., for fifteen years, perhaps I can give a few pointers in regards to brazing.

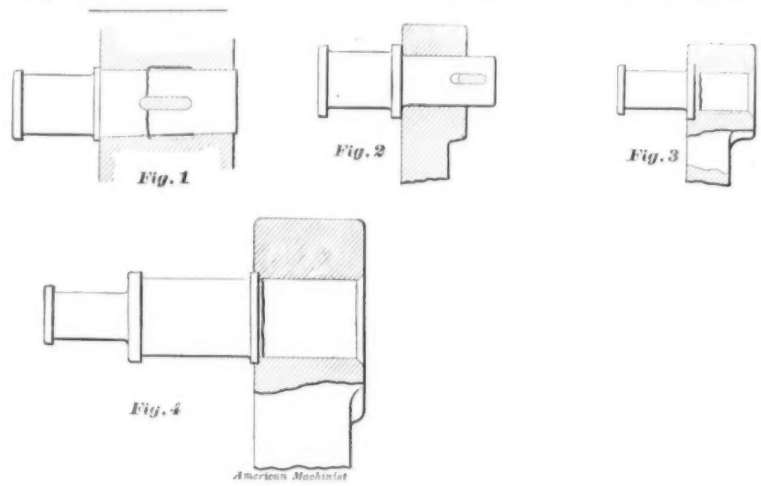
Brazing spelter and borax are things of the past to first-class brazers, and in their place comes the wire or rod brass and boracic acid for a flux.

A proper heating of the joint is nine-tenths of the brazing, and the heaviest part of the joint should always be heated first, the heat to be extended up towards the tube. This done we are ready to apply the brass. Anneal the end of the rod by heating while the joint is getting hot, and after dipping the rod into boracic acid, apply to the joint; the rod melting at the end will flow into the joint, and will not run over the work, which, when it occurs, makes a lot of unnecessary filing. After the joint has cooled, submerge in hot soda water; this will take off every particle of the acid, leaving only the brass to be filed, and will not injure the metal as sulphuric acid will. In brazing a hollow inside joint, a good way is to make a coil of the brazing rod the exact size of the inside diameter of the tube, cut it into rings and force into the tube at the place where the forging ends; pin your work and heat in the same manner as outside brazing, heating the thickest part first, and gradually heat towards the ring. Flux or draw the melted ring towards the crack in the joint by the brazing rod and a little boracic acid. Dissolve the acid in hot soda water and you will find a nice clean joint with very little brass to file off.

The rod has superseded the old-time way of brazing with the spelter, and can be applied to surface brazing as well, makes a much neater and stronger job, besides being economical; and there is no occasion to send "files to the bow-wows."

A QUAKER BRAZER.

Philadelphia, Pa.



Crank Pin Failures—Turning Cones or Tapers.

Editor American Machinist:

Although as a general rule it may be said that a deal more careful thought is now bestowed on the design of engine details than was the case even only a few years since, it is certainly just as truly a fact that there is still ample room for improvement in several directions. Such a statement is well supported by even a very superficial study of the statistics of engine breakdowns, as for example, those which are to be found embodied in the annual reports of some of the British insurance companies. In one of these just issued, and which has been prepared by a well-known engineer, Mr. M. Longridge, I find a tabulated list of over 130 engine breakdowns, together with notes and comments relative to the nature and cause of the damage in each case. Broadly, these breakdowns may be attributed to: (1) Accident; (2) Negligence, either of owner or attendant; (3) Old defects or wear and tear; (4) Weakness, faulty design or bad workmanship. Curiously enough, almost an exactly equal percentage of the total breakdowns are placed under each of the above four categories.

Among the cases referred to under the heading of weakness or bad design, are three examples of crank-pin breakages. In the first of these the arrangement adopted for securing the pin in the crank was of a form now rarely used. The pin, which was made slightly taper, had a collar, and was drawn into the eye by a cotter, which in this case passed through the crank, as shown in Fig. 1. I do not imagine that many will care to undertake to defend this arrangement, for if the pin is to be held in place by a cotter the better arrangement shown in Fig. 2 might be adopted with advantage from several points of view. But leaving on one side for the moment, the advisability of using a cotter at all, the point is worth considering whether it is possible, when the collar is drawn up to the face of the crank, to insure that the conical body of the pin has a fair bearing throughout its length. This is a point which has often been raised, and is again adverted to by the writer of the report in question. No doubt it requires some amount of care to obtain an even bearing pressure on each of the two surfaces, and it is easy to see that if the pressure is taken mainly by the collar the arm of the lever through which the pressure tends to bend the pin, may be considerably longer than that from the center of the journal to the face of the crank, as ordinarily assumed. Some such condition appears to have existed in the case mentioned, as the pin broke in the manner indicated in the figure. It is worth noting that with either of the arrangements shown in Figs. 1 and 2, the failure of the pin in the shank allows the whole to fall out of the crank eye. Obviously the same disadvantage attends the use of similarly tapered pins secured at the back either by a nut or simple riveting.

In two other cases mentioned in the report the shanks were cylindrical, the pin in each case being provided with a collar which took a bearing in a bored recess in the face of the crank. These pins were put in from the faces of the cranks and riveted over at the backs. As both broke inside the crank eyes, as indicated in Figs. 3 and 4, the inference is that in neither case did the crank grip and support the shanks of the pins throughout their length. As it is not uncommonly found that such pins become loose in the crank eye, it would appear that this is what first occurred in the cases referred to, and that afterwards the hole in the eye becoming worn at the crank end, the bending moment on the pin would be considerably increased, and failure ensue.

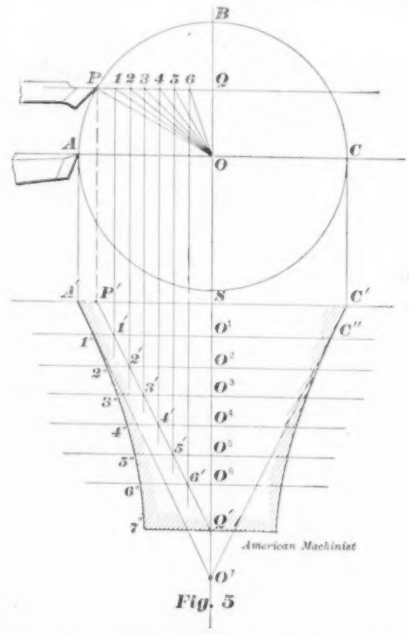


Fig. 5

The plan adopted in each of these latter cases, of leaving a square, sharp shoulder behind the collar, is much to be condemned, and in one of these cases at least the fracture commenced at the abrupt change of diameter.

No doubt the best method of securing the pin in the crank is by forcing it in by hydraulic or other pressure, and if this is carefully done, there is no need for a key or spline to prevent it turning in the eye. When the crank is shrunk on to both shaft and pin, a perfect job does not always result, unless the hole in the crank eye is finished after the crank has been secured in position on the shaft.

Writing of taper-shank crank pins recalls to mind a point in turning cones or tapers which I do not recollect having seen discussed in the AMERICAN MACHINIST, although it is scarcely likely that the matter can have escaped notice. It is sometimes said that if, when the rest is set for turning a cone of given dimensions, the tool is fixed above or below the center, that the cone will be found to be too large at the small end. Is it not the fact, however, that unless the tool is set exactly in line with the centers that it is *impossible to produce a cone at all?*

Let us take a case much exaggerated in order to bring out the point at issue. In Fig. 5, $A\ B\ C$ is a cone in elevation, and $A^1\ O^7\ C^1$, the same solid in plan. To form this solid of revolution the cutting edge of the tool was placed at A in the line of the centers, the path of the tool in plan being represented by the line $A^1\ O^7$. Keeping the setting of the rest unaltered we will elevate the tool until P represents its point of application in elevation. Evidently the path of the tool will now be represented by $I^1\ Q^1$ in plan, and as at the latter point the tool will be vertically over the axis of the solid, it follows that the length of the latter has been reduced from $S\ O^7$ to $S\ Q^1$, this being one of the results of elevating the tool.

But let us examine the *shape* of the new solid of revolution produced in this manner. Evidently at the large diameter the radius of the solid being turned is $O\ P = O\ A$, so that in drawing the plan we lay off from S, a distance $S\ A^1 = O\ A$. Taking a second position of the tool after it has moved from P^1 to 1^1 in plan and from P to 1 in elevation, it is seen that the radius of the solid is now $O\ 1$ and laying this length off from O^1 in plan we obtain the point $1''$. Similarly the other points $2''$ $3''$, etc., are obtained, and the curve drawn through these represents in outline the solid which would result from such an abnormal elevation of the tool. Obviously the smaller the displacement of the tool from the plane of the centers the less will the deviation be, but it is clear that the difference will be one of degree only, and that in no case is it possible to originate a conical surface unless the tool is exactly in the line of the centers. M. E.

[The fact that a curved outline is produced by a tool cutting above the center under the conditions named has been previously shown in these columns, but as it was done a number of years ago it may be well to again call attention to the matter.—ED.]

Some Reasons for the Outflow of Skilled Mechanics.

Editor American Machinist:

If a young man commences life as a clerk, in three or four years by close application to business, if he has the good fortune to have a little money, or good sense to save it, he is qualified to go into business for himself; the same may be said of a carpenter, plumber, painter, or, in fact, of almost any trade except that of machinist. It takes him a long time to master all the details, and requires a small fortune to commence doing business.

A good musician or preacher can get as much for three hundred hours as a mechanic of the same ability gets for three hundred days. An able physician or lawyer can almost demand his own price for services rendered; but one hundred dollars per month is considered a large price for a skilled mechanic.

In writing this sketch I have in mind a friend who has held responsible positions for a number of years, and is of reliable habits, well up in steam engineering, and qualified to fill any mechanical position that might offer, and yet has been obliged to work for two and a half to three dollars per day for over two years. Another who has for years made a study of everything connected with the manufacturing business, a good correspondent and manager of help, capable of

designing and estimating on special machinery and the cost of goods produced, and of making all calculations for power equipment, has never been able to secure a place that would pay over twelve hundred dollars per year; and still another who, after some twenty years of shop work, had saved a small sum, left the shop and started a small store, and is now making more than he ever did before, with a great deal less strain on brain and nerves. Is it any wonder that men leave the factory when they can do so much better in a corner grocery or little cigar store or news stand without the risk of being crippled for life, and with a reasonable assurance of a comfortable income when old age reaches them?

There appears to be but one way to keep good men in the field, that is to give them the appreciation that is due to their qualifitions, and to pay them as well as other professions are paid for the same ability.

Hartford, Conn. R. L. A

Reaming Two Holes in Line—Temporary Hoisting Arrangement.

Editor American Machinist:

Where it is necessary to ream two holes which have considerable space between them, but must be in absolute axial alignment—as in the case of bearings on the opposite sides of a machine frame—they employ in the Hugo Bilgram shops a method

which I have never seen elsewhere, and which produces excellent results. The holes are first reamed nearly to size; then, the frames being set up parallel in proper position, the drilling is done *in situ;* each hole is made the point of support for the reamer while it is drilling the opposite hole, and it is drawn through instead of being forced through, that is, the reamer is worked backwards. Its form is about as shown in the sketch; *A* being the cutting portion (of the "shell" type), *B* the shank, *D* the squared end and *C* a tapered portion, the small end of which is of the diameter of the unfinished and the large end that of the finished hole; the distance between *C* and *A* being slightly in excess of that between the frames. The tool is, of course, sectional. This insures accurate alignment.

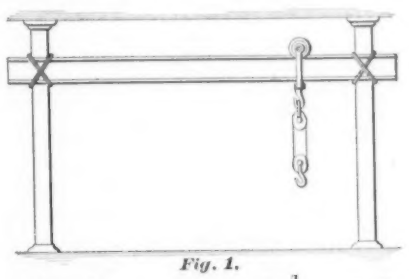


Fig. 1.

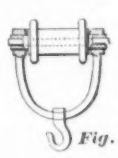


Fig. 2.

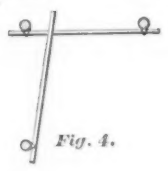


Fig. 4.

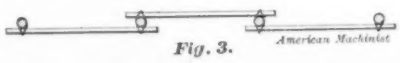


Fig. 3.

Once in a while it becomes necessary in almost any shop to carry an extraordinarily heavy piece to or from some quarter that is not served by the cranes. It is of advantage to be able to do this even if the floor is cluttered up with other pieces which are not ready to be moved. Very often a heavy casting is moved out of the way to make room for another one along the aisles between the machine tools. Sometimes it is necessary to install a new machine in place of an old one while the floor is pretty well covered with work or machines, and then, whether the shop has railways down the aisles or not, it is desirable to be able to handle the heavy pieces from above instead of along the floor level. This is often the case in shops where there is a big central traveling crane serving a long "nave" bounded by galleries on each side, which it cannot reach, and is not ordinarily supposed to reach, even through railways or by trucks.

It would seem a simple matter to rig up a temporary overhead single-rail railway; but instead, very often, tools are moved to right or left and work not yet ready to remove is taken away in order to permit the pieces to be handled on the floor level.

The sketches show a rig that it takes but few men to put up and take down, and by means of which quite heavy pieces may be lifted clear above everything on the floor and got out of the way. Assuming that the shop has posts or columns supporting its roof or a story above, and that an iron I-beam is available, all that is necessary is to lash the beam to the columns as shown (Fig. 1), and having straddled it with a flanged wheel of spool shape (Fig. 2), sling from this last the hoisting apparatus as shown. The load may be lifted clear and run along as far as the end of the rail or the next post, and if it is necessary to run it at right angles it may then be shifted to a similar tackle on a similar beam placed across the first, and its other end either resting on a parallel beam or lashed to another post, as at Fig. 4.

The spool or flanged wheel may have, in order to save friction, a plain length of shafting of small diameter passing through it and bearing on each end a sleeve of iron tubing bored inside to fit it and turned outside to receive eyes from which depend the upper block of the tackle.

If there is any question about the strength of the lashings, they may be supplemented by plain shores of ordinary timbers, placed vertically, or nearly so, alongside of the columns.

With two sets of tackle blocks a load may be transferred from almost any column in the shop to almost any other; one hoist taking it from the other. Thus in Fig. 3 it is carried in one straight line along a row of columns, while in Fig. 4 it is switched off to a line of columns at right angles with that along which it first started.

G.

Planet and Differential Gears.

Editor American Machinist:

In the issue of September 19th there is an article condemning *in toto* the use of planetary or differential gearing as a speed-reducing mechanism. Mr. Grant states that "it has no application in practice, and is suitable only for a college gear model which has only the pressure of the atmosphere to overcome."

Brainard has some gear cutters employing planetary reducing gears for the feed train. Pratt & Whitney have the same thing on some of their milling machines, and the Niles Tool Works Co. employ such devices in the feed mechanism of their heaviest cylinder boring machines. It follows that these firms are outside of the domain of practice, or that the feed resistances of milling and boring machines are no greater than the pressure of the atmosphere, and that the use of heavy feed trains such as are usually employed proves their designers to be outrageously on the safe side.

Joking aside, if Mr. Grant has tried a planetary reducing train between the cutter and feed shafts of a gear-cutting machine, and found this not to answer, the fault did not lie with his use of planetary gearing, *per se*, but was due to the fact that improper proportions to sustain the loads imposed were adopted. "The combination of high working speed and high working pressure" (on the gear teeth) will not "soon wear the thing out," provided the designer has properly chosen his dimensions so as not to exceed safe limits of speed and pressure—which rule is applicable to all designs as well, but he must also so arrange his parts as to insure them against deformation. Very often planetary gears are so journaled as to permit springing, in which case nothing but failure need be looked for.

In a recent number there was illustrated a speed-reducing device by Mr. Richards, used by Mr. Eckley B. Cox in his boiler grate, which consisted of a double set of planet gears and reduced the initial speed (if memory serves me correctly) some 3,500 times, and that arrangement contained only four gears.

Does Mr. Grant really think that a train of even comparable simplicity and compactness could be produced by continuous spur-gear reduction such as he proposes? With four pairs of gears, that is, eight altogether, he would have in each gear pair a ratio of nearly 8; using ten gears arranged in five pairs he would still have for each pair a ratio of over 7. The bills he would run up to pay for his arrangement would certainly foot up considerably higher than those incurred by Mr. Richards.

As a matter of fact, differential gears have a very important place in mechanics, and would be more widely used were the real simplicity of their calculation for speed ratios more generally understood.

Hamilton, Ohio. HENRY HESS.

Draining Steam Drum—Drying by Heated Air.

Editor American Machinist:

I think your correspondent, S. A. Smith, will drain his steam drum to best advantage by running pipes *e* and *f* below the water line. This, for two reasons: First, if steam pipes from boilers to drum are not quite large size, there will be a current of steam up the drain pipe into the drum also, and this may retard the drainage. Again, if drain pipe empties into steam space of boiler, there will be some condensation of steam, slight, it is true, but still operating. Better deliver it under water; it is not necessary to carry it to bottom of boiler.

Tecumseh Swift's wood drying kiln article recalls a dry house connected to a shop I worked in some years ago. This was of brick, with a large space where lumber was "stuck up" in open order over a grating, beneath which was a steam coil system. Adjoining this was another chamber, as long and high as the dry space, but only about eighteen inches wide. This was filled with a coil of one inch pipe, arranged vertically, with manifolds at top and bottom, through which cold water circulated, entering at the top manifolds. Horizontal slits opened from this chamber through the partition wall into the dry house, at top and bottom; otherwise it was tightly closed, except where a drain pipe carried off the condensed moisture which ran down the cold pipes to the trough-shaped cemented floor, and so out. There was no blower. The hot, moist air went out at openings in partition top to side chamber, deposited its load of vapor on the cold coils, fell by gravity to openings at bottom and so back to dry house under steam coils, to be heated and sent on its never-ending round. When newly filled with lumber, the way the condensed water ran from the drain was a caution. I think there was a patent on this, but it must have become public property long since. SIX H.

Sixteenth Annual Meeting of the American Society of Mechanical Engineers.

The sixteenth annual meeting of the above-named society will be held at the society's house, commencing December 3d, and the program is similar to the usual one for the New York meetings. The "Reception and Conversazione" will be held Thursday evening at Delmonico's, and the afternoons will as usual be without sessions, leaving members free to spend the time as may seem best to them. The following papers will be presented and discussed:

"Water Power of Caratunk Falls, Kennebec River, Me." By Samuel McElroy.

"Water Power; its Generation and Transmission." By Samuel Webber.

"Means Adopted for Saving Oil in a Large Oil Refinery." By C. E. Emery.

"The Reliability of Throttling Calorimeters." By Jas. E. Denton.

"Some Experiments with the Throttling Calorimeter." By A. A. Goubert and E. H. Peabody.

"Comparative Tests of Steam Boilers, with Different Kinds of Coal." By C. E. Emery.

"Experiments on the Friction of Screws." By Albert Kingsbury.

"Tests of a 10 H. P. De Laval Steam Turbine." By W. F. M. Goss.

"Recording Device for Testing Machines." By Geo. W. Bissell.

"Effects of Temperature on the Strength of Wrought-Iron and Steel." By R. C. Carpenter.

"Some Data Relating to Forge Shop Design." By P. M. Chamberlain.

"Experimental Method of Determining the Effective Center of the Light Emitted from a Standard Photometric Burner." By D. S. Jacobus.

"The Proportions of High Speed Engines." By Jno. H. Barr.

Municipal Control of Public Functions.

It would appear evident to most people who take note of such matters that there is a growing sentiment in favor of municipal ownership of all those things which an urban community must have in order to exist, and in which there can, in the nature of things, be no possibility of free competition; where the public streets must be used in order to carry on the business, and can advantageously be used by only one company—as, for instance, in supplying water, gas, electric light, transit over rails, etc.

Prof. Edward W. Bemis, whose dismissal from Chicago University and the subsequent attempts to explain the dismissal were so discreditable to the institution, has a thoughtful, dignified and instructive article on the subject in the November number of *Electric Power*, and this has stirred up some of the electrical journals, which seem to think it is their special duty to show how much better off we are by having these public functions performed by franchise-stealing and alderman-purchasing corporations. One of these journals refers to Professor Bemis' citation of the successful and satisfactory working of the cable road on the East River Bridge and says:

Can it be possible that Professor Bemis knows the facts in regard to the Brooklyn Bridge? * * * * The Brooklyn Bridge, with its 3-cent fare for about a mile, charges more than any private company we know of in the Union. As for the service, it is a disgrace to civilization, and every change made by the governing board only adds to the distress and inconvenience and delay inflicted on the passengers. If there is one institution in this part of the world that exacts an outrageous tariff and gives a wretched return, it is the municipal Brooklyn Bridge car line. And yet a public teacher like Professor Bemis, who prides himself on martyrdom for the truth, talks about its success being known to everybody and about its voluntary generosity in reducing fares!

As to the charges on the bridge cars being high, we should say that a comparison between a road bed that cost $10,000,000 per mile and one that cost next to nothing per mile is an unfair one, and we also think that the car service on the bridge is not quite so bad as our contemporary would have us believe. It certainly compares very favorably with that of the privately owned elevated roads in New York, and, in fact, is at least fairly satisfactory considering all the conditions.

Since the publication of our description of the Kane-Pennington motor, in our issue of the 7th, we have had many inquiries for the address of the manufacturers of the motor. Though we have had no correspondence with the company, we supposed at the time of the publication of the article that the address was Kane-Pennington Co., Racine, Wis. From recent correspondence, we are not quite sure that that is the correct address, but at any rate, such address will reach them, as the motor was built there, though we believe the company has a business office in Chicago.

A proprietor of a prosperous foundry in Manchester, with branches in London and Liverpool, "a shabby little fellow with a Scotch brogue, and looking more like one of his own foremen than like an author," is J. M. Barrie, who wrote "The Little Minister," and is in the front rank of popularity.

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Our Market Report.

By reference to our department that has been called "Machinists' Supplies and Iron," it will be found that we have expanded it somewhat, and that it now gives a good general idea of the commercial features of the time, so far as they relate directly to machinery interests. It is our intention to continue to make the technical side of the business our principal feature, but everyone who takes any part in machine construction is vitally interested in the market for machinery and in the prices of the materials and supplies that enter into its construction. No paper in this country, so far as we know, devotes special attention to the commercial side of the machinery business, and we have engaged a man whose experience in similar work, together with the fact that he is also possessed of the necessary technical knowledge, fits him for giving, each week, an intelligent and accurate report of actual conditions at the time of going to press; which time will be indicated in the report, but for the present will be Saturday previous to our day of publication.

We would recommend that, not only those who sell machines, but also those who do the work of construction look over this report from week to week. Shop men are too apt to overlook, or to forget the fact that the commercial side of the machine business is important, and that machinery cannot be manufactured unless it can also be sold; and that finding a market for it in face of the keen competition which is encountered in many lines is a work of prime importance and one which often involves a very great drain upon the vital energies of a shop proprietor, who, in addition to this, must face other heavy responsibilities. We shall hope our weekly reports will be of some assistance in this work of the machine shop proprietor, and in thus assisting him we shall be assisting everyone who has to do with machine construction.

Some Possible Products of Producer Gas.

It has been generally known to the mechanical world for a considerable time that the gas engine, and especially in connection with what is known as producer gas, gives promise of revolutionizing the power supply of the world. It is stated that to-day gas engines are in operation whose consumption of gas represents less than one pound of coal per horse-power hour, while we know that the best steam engines in existence consume, say, a pound and a half, those in very general use three or four pounds, the best locomotives seven or eight pounds, while twelve pounds and upwards are not infrequent rates of consumption. Gas engines have not as yet been developed to as large sizes as are desirable for extensive power plants, and the regulation of the speed of the engines under suddenly varying loads is as yet very far from what is required; still in these respects progress is being made daily. Engines up to five hundred horse-power are in operation, and more than one electric plant is already driven entirely by gas engines, so that the complete adaptation of the gas engine to all the various service for which the stationary steam engine has been used is practically assured. It is understood that Mr. George Westinghouse has of late been giving his attention to the gas engine, and that he has materially helped to advance it toward perfection. It is reported also that Mr. Westinghouse has been giving the directors of the Pennsylvania Railroad a lesson in power economy, telling them that they are wasting in their now antiquated steam locomotives at least 4,000,000 tons of coal per annum, or that the substitution of electricity, obtained through producer gas and the gas engine, would save them $5,000,000 per year, a sum that would amply and quickly justify the large expenditure that would be involved in the change of machinery.

The mechanical ideal to-day is the direct evolution of the electrical current from the coal pile without the intervention of the power-driven generator. It may be that we are approaching this, but producer gas and the gas engine give no hint of it. Their attack is directed at the steam engine alone. Power is cheapened, and the results obtained through electricity as a power transmitter are cheapened with it. In this transition time it may not be safely said whether the ultimate result will be the advancement of electricity and the extension of its employment as a power transmitter or not. When we have said that the gas engine gives a higher fuel economy than the steam engine we have not said it all. With the gas engine the high economy is found in the smallest engine as well as in the largest, while the small steam engine is notoriously wasteful. The first cost of the engine and boiler of small power is high and their maintenance and operation are costly and troublesome, and the electric motor has offered in comparison undoubted advantages of economy and convenience, which the people have been rather slow to avail themselves of. But if gas engines are substituted for steam engines and boilers, at one-third or one-quarter the cost of apparatus, with less than one-quarter the fuel cost, and not requiring one-tenth the attention, the electric motor will find the task of knocking them out a far different one from that of superseding the small steam engines. The horseless carriage is the sensation of the hour, and no one can doubt its complete dominion in the near future. The gas, the gasoline and the oil engine are, as we know, practically identical; in the form of the gas engine, why may it not put the trolley car upon the defensive and before long drive it out of existence? The gas engine on the street car must of necessity mean cheaper power than the gas engine at the power house, with all the apparatus of electrical generation and transmission between, and the carrying of a sufficient supply of gas on the car for any length of trip may be provided for without the slightest inconvenience.

It is worth while for the railroads to inquire whether producer gas, which promises them such a saving when working for them indirectly through electricity, may not be able to render them a cheaper and more convenient service by being employed directly. It is difficult to think of a locomotive without boiler or tender; but in place of boiler and tender an enormous storage tank of gas and a suitable gas engine would not comprise a more incongruous monster than the electric locomotive.

The gas locomotive is apparently as easily within the bounds of practical possibility as is the electric locomotive, and would have some important advantages over the latter. It may easily happen that electrical men who think they are merely showing how the electric motor can the more easily overcome the steam locomotive, are in reality starting a movement that will end in shelving both of them.

Keep the Object in View.

There can be no doubt but that Commodore Loring did the young Society of Naval Architects and Engineers a valuable service by bringing about the defeat of Rear-Admiral Mead's proposed resolution memorializing Congress to promote the construction of the Nicaragua Canal.

Judging from the applause which greeted the presentation of the resolutions, they would have been adopted by the society, had not Mr. Loring, in presenting his minority report, and in subsequent discussion, shown clearly the indisputable fact that the matter is one with which the society as such has no business to meddle. Any society or organization, formed for a specific purpose, must always be on its guard against the efforts of those men who, though well meaning enough in most cases, find great difficulty in keeping themselves within the scope of the question under discussion, or within the lines laid down by the constitution and by-laws of the association—men whose minds, though admirable in all other respects perhaps, will yet persist in wobbling a little, and can scarcely be kept upon the straight track. Especially dangerous are those who imagine that considerations of patriotism give sufficient justification for injecting into the proceedings and records of a scientific or technical society, expressions of opinion on all sorts of questions absolutely unrelated to the objects of the society.

If we should print in these columns a poem eulogizing Washington, and should attempt to justify it on the ground that the editors of this paper and all its readers are patriots, and that we all glory in the fame of Washington, it would appear utterly absurd, simply because this paper is conducted, subscribed for and read for an entirely different purpose, and our readers whose patriotism takes the form of a desire to read poems about our national heroes, expect to read them elsewhere. Yet by so doing we should make ourselves no more ridiculous than those would make a technical society who should cause it to express an opinion on the beauties of the Monroe Doctrine, the desirability of annexing Hawaii, or the right of the Cubans to manage their own affairs.

Much fine oratory was expended in setting forth the patriotic aspects of the Nicaragua Canal questions, but to all of that the Commodore, as opportunity offered, kept saying that it was all very fine, that he admired it very much, but that nevertheless the resolution was utterly foreign to the avowed objects of the society, *i. e.*, the promotion and development of the science and art of steamship construction. It is fortunate for the society that his common-sense views prevailed, and that the resolutions were defeated by a decisive majority.

The same danger arises in the A. S. M. E. occasionally, and an instance of it was shown when a determined effort was made to have the society carry on a series of tests to determine the relative advantages of two different types of locomotives. The society was roundly denounced for refusing to do this, but it was right for it to refuse, nevertheless, and an example of the ridiculous result of pursuing the opposite course is to be seen in the case of the official organ of a manufacturers' club, to which we called attention not long since—an organ which vehemently vociferates opinions on all sorts of questions about which members of the club differ, and respecting which there is no possibility of advantage in placing itself on record, but rather the contrary.

A Boston paper is being quoted as advocating a "train captain," whose duty it should be to look after signals and control the movements of the train, the alleged reason being that the engineer's attention is too much taken up with care of his machine.

In these days locomotive runners give relatively little attention to the machine when on the road, and the best "train captain" is the man who handles the throttle, and who knows what can and what cannot be done, and can act instantly when the occasion for acting arises.

Some one has been taking indicator cards to determine whether belts or ropes absorb the most power, and some one else compares the operation to that of first cracking a hazel nut and then a walnut under a steam hammer, and then comparing cards from the hammer cylinder.

Wm. H. Ruef, who was for some years connected with the Atlas Works, at Indianapolis, is now superintendent of the shops of the Indiana Bicycle Co., of the same place.

Death of H. G. Ashton.

Henry G. Ashton, the inventor of the well-known Ashton safety valve, died at his home, Somerville, Mass., on November 12th, of apoplexy. Mr. Ashton was born at Norfolk, England, in 1846. He came to Boston in 1869, and became superintendent of the Hinckly Locomotive Works. The safety valve was invented in 1872, and brought his name into prominence in the engineering world.

Literary Notes.

THE PRACTICAL ENGINEER POCKET-BOOK AND DIARY FOR 1896. Edited by W. H. Fowler, Wh. Sc., M. I. M. E., A. M. I. C. E.

This is a book which has been issued annually for some years by our English contemporary, this being the seventh edition, and a marked advance on preceding ones. In it will be found a great deal of classified information useful to mechanics and mechanical engineers. There are many useful tables, formulæ and rules, and the book is of a size which permits it to be readily carried in the pocket. It is well indexed, and, though it is especially adapted to English practice, is yet a book that will prove useful to any engineer or mechanic who can read English. It is nicely bound in morocco, and has 403 pages, $3\frac{1}{2}' \times 5\frac{1}{4}'$, and is sold at 1/6 net, or about $37\frac{1}{2}$ cents our money. Published by Technical Publishing Co., 6 Victoria Station Approach, Manchester, England.

ELEMENTS OF DESCRIPTIVE GEOMETRY, With Applications to Isometrical Drawing and Cavalier Projection. By Charles William MacCord, A. M., Sc. D., Professor of Mechanical Drawing in the Stevens Institute of Technology, Hoboken, N. J.; formerly chief draftsman for Capt. John Ericsson; author of "Kinematics," etc.

Descriptive geometry is the foundation of mechanical drawing; it teaches how to make, with mathematical exactness, drawings of geometrical magnitudes, and the solutions of problems relating to them, hence a familiarity with the principles expounded in descriptive geometry is of the utmost importance to those who wish to become thorough draftsmen. Students often find this study to be a stumbling block due to the difficulty in forming clear conceptions of some of the elementary principles. In this work, we believe, this difficulty is to a great extent removed by the introduction of pictorial representations, and by the treatment of the subject which differs in some respects from that in other text-books. Clearness and simplicity in statements, and good, clear illustrations, are some of the features which will be appreciated by students. The arrangement and character of the problems are such as to make the work suitable for use in colleges and scientific schools, and also by those who may wish to acquire some knowledge of the subject without the aid of an instructor. The work can be recommended to all interested in the science of descriptive geometry, and the principles of mechanical drawing. It is published by John Wiley & Sons, New York. Price, $3.

THE WEEKLY REVIEW is the name of a new educational journal published by the Co-operative Educational Association at Ann Arbor, Mich. The object of this association, in which object the *Review* is intended to assist, is to afford a means by which those who have had no opportunity for acquiring a liberal education can educate themselves, without giving up their regular occupation and at comparatively little expense.

Questions and Answers.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet. We cannot undertake to answer questions in "next issue." This department is usually crowded, and questions must wait their turn to be answered. Neither can we undertake to solve mechanical or engineering problems, and send answers by mail.

(406) C. S. C., Altoona, Pa., asks: If crude petroleum is used for lubricating the cylinders of a small condensing engine, and the water due to condensation returned to boiler without having the oil separated from it, is it likely that the boiler sheets will be damaged? *A.*—It is bad practice to use feed water mixed with crude petroleum or any kind of oil which has been used for lubricating purposes. The boiler sheets may be damaged by such practice; it is unsafe and unwise.

(407) H. C. D., Schenectady, N. Y., writes: Please give a formula or rule for finding the distance across the corners of a given square, so as to enable me to find the exact diameter of a round piece on the end of which a square is to be cut. *A.*—Multiply the side of the square by the constant 1.414; the product will be the distance across the corners of the square. For example, the side of a square is 2 inches long, what will be the distance across corners?

$$2 \times 1.414 = 2.828 \text{ inches,}$$

which is the required distance. In order that this constant may be easily remembered, or found if forgotten, it should be said that it is the square root of 2, and is applicable to all squares whatever their size may be, but cannot be used for other rectangles.

(408) L. P., La Cidra, Cuba, writes: In making U-shaped hydraulic packing rings, I followed the directions recently given in your columns. The result was not satisfactory. The piston and mold are the same size, $11\frac{1}{4}$ inches diameter. The leather was soaked over night, and after being pressed in the mold was placed over a boiler for four or five days; after the ring was taken out, it was trimmed and soaked in liquid tallow for 24 hours. Four rings were treated in the same way, the tallow being at different temperatures, but all rings shrunk about $\frac{1}{8}$ inch and cannot be used. Please inform me if it is possible that the quality of the leather or tallow could cause the trouble, or should the mold be made $\frac{1}{8}$ inch larger to allow for the shrinkage? *A.*—The shrinkage of the leather should always be allowed for, which will depend on the kind of leather used. If you use the same quality of leather, make the mold $\frac{1}{8}$ inch larger than before. Do not dry it too quickly.

(409) H. C. D., Schenectady, N. Y., writes: Will you kindly explain how to figure the gears to cut 3 threads to $1\frac{1}{8}$ inches, the lead screw having 4 threads to an inch? *A.*—We first find out the pitch of the screw to be cut, or the number of threads to the inch, which is done by simple proportion like this:

$1\frac{1}{8}$ inches : 1 inch : : 3 threads :

then $(3 \times 1) \div 1\frac{1}{8} = 2\frac{2}{3}$ threads to an inch. Not knowing anything about the lathe to be used, we suppose that the stud which carries the driving gear for screw cutting revolves at the same speed as the lathe spindle, and then the driving gear on this stud and the driven gear on the screw should have to each other the same ratio (inversely) as that of the lead screw to the screw to be cut. Selecting some gear that we may have for a driving gear on the stud, say, 60, the question then becomes one of simple proportion, and we state it like this:

$$4 : 2\tfrac{2}{3} : : 60 :$$

then $(60 \times 2\frac{2}{3}) \div 4 = 40$ teeth for screw gear. These gears 60 and 40, it will be noticed, are as 3 is to 2, and any gears bearing that ratio will cut the thread. If the stud revolves at one-half the speed of the lathe spindle the stud gear should be twice as large as above computed in proportion to the screw gear.

(410) R. J., Oswego, N. Y., writes: I want to get some information on spraying feed water under the following conditions: A horizontal boiler is fitted with a vertical cylinder, like a dome, a feed pipe enters about a foot from the top head, and the end of the pipe is fitted with a ball nozzle to spray the feed; now, assuming 100 pounds steam pressure, I am anxious to know if the spray in the chamber will be anything like what it would be with the same appliance if the water was escaping into the atmosphere. I would also like to know if you would consider it advisable to reduce the end of the pipe so as to increase the flow. The feed would be continuous and would not require the full area of pipe fitted usually to this size of boiler. *A.*—The action of the ball nozzle requires the water to escape at considerable velocity, or to have a large excess of pressure behind it, so that with 100 pounds pressure in the boiler there should probably be not less than 150 pounds pressure in the feed pipe, and the nozzle should be small enough to maintain this difference of pressure and not discharge the water too rapidly. As far as spraying the water is concerned, other devices could be employed quite as effective as the ball nozzle. Two small streams pointing towards each other, and knocking each other all to pieces, make a very effective spraying device; but this also, of course, requires an excess of pressure behind it.

(411) E. H., Ithaca, N. Y., writes: As in locomotive pistons the object is to secure extreme lightness and strength consistent with economy in construction, we must make the piston of minimum thickness, and consequently have a minimum bearing surface of piston on cylinder wall. In view of these facts, what would be the maximum allowable weight of piston per square inch of projected bearing surface? Also, what is considered the minimum distance between the rings, under the condition that all the piston weight is sustained by the surface between the rings? *A.*—Locomotive pistons are not designed in the manner indicated by your questions. The first thing to determine is the depth of the piston at the center, which will allow the piston to be securely fastened to the piston rod; this depth will always be sufficient for the various types of packing rings. The next step will be to decide on the type of packing rings to be used. Sometimes two brass packing rings are used; these are grooved out around the periphery to receive babbitt metal; the rings are placed side by side, without any space between them, and are made as wide as the depth previously determined will allow. These packing rings sustain the weight of the piston. Sometimes two simple cast-iron rings are sprung into grooves turned into the piston. For cylinders 9 inches diameter these rings are $\frac{1}{4}$ inch wide, with solid metal $1\frac{1}{4}$ inches wide between them. The width of these rings and distance between them gradually increases with the increase of diameter; for pistons 22 inches diameter the width of these rings is generally $\frac{3}{4}$ inch, with solid metal $1\frac{1}{4}$ inches wide between the rings. The above refers to locomotive practice only.

(412) A. C., Syracuse, N. Y., writes: Will you please tell through your columns how I can cut a groove in a piece of tool steel $2\frac{3}{4}$ inches diameter, the groove to be $\frac{3}{8}$ inch deep and $\frac{5}{64}$ inch wide at the top, tapering to $\frac{1}{16}$ at the bottom, the bottom being round or semicircular? *A.*—We must assume first of all that the steel is thoroughly annealed. Then it should be possible to cut in a parallel groove $\frac{1}{16}$ inch wide and $\frac{19}{32}$ inch deep with a carefully made and adjusted square-nosed tool. The clearance should be slight on the tool, the end should be perfectly square, it should be set in the rest with a square, so that it would be true both vertically and horizontally; it should not be any longer than just enough to reach in to the proper depth, and only thin but good lard oil should be used. No mineral oil is to be trusted for a moment in a case like this. When the groove is cut in to the proper depth the end of the same tool may be rounded and used to round the bottom. Then the more difficult job of tapering out the sides is to be done. Of course no tool so thin would be able to stand a cut of nearly $\frac{3}{8}$ inch on each side of it all at once. A gage for grinding a taper tool could be made corresponding to the taper groove. If no file could be found thin enough to go into the slot, the gage could be made of two separate thin strips of metal, clamped to the required relative position by laying a piece on each side of them and clamping the whole together. A taper tool could now be ground thick enough to turn out the taper groove to about $\frac{1}{8}$ inch deep and to the full width required. Then the tool could be ground thinner by the gage and the groove tapered out an eighth of an inch deeper, and so on until it was finished. We believe it to be possible to do the job in this way with sufficient care and patience. If there were several to do, it would be proper to think of the milling machine. The piece could be mounted upon the milling centers placed crosswise and then, slowly revolving it, a plain groove could be cut with a slitting saw, and the groove could be finished to the required shape with a revolving file specially made for the work. By setting a compound rest to the proper angle the sides of the groove might be brought to the required shape, one at a time, but delicate and excellent tools would be required.

(413) W. H., New Haven, Conn., writes: Please give rule for computing the diameter of pulley on the main line shaft to run a shaper under the following conditions: The diameter of the pulley on the shaper is 12 inches; its shaft has to make 12 revolutions to move the ram 1 foot, and I wish to run the ram at a speed of 12 feet per minute. The pulley on the countershaft which drives the machine is 9 inches diameter, and the pulley on the countershaft by which the shaft is driven from the main line shaft is 10 inches diameter; the main line shaft makes 175 revolutions. What will be the diameter of the pulley on this shaft? *A.*—For all calculations of this kind it is only necessary to remember the following fundamental rule: The diameter of the driving pulley multiplied by its number of revolutions per minute is numerically equal to the diameter of the driven pulley multiplied by its number of revolutions per minute. Or, in order to express this rule in symbols, let D = diameter of the driving pulley, and R = number of its revolutions, d = diameter of driven pulley, and r = number of its revolutions per minute; then we have

$$D \times R = d \times r. \qquad (1)$$

The shaft of the machine makes 12 revolutions for 1 foot travel of the ram; hence for a travel 12 feet per minute the pulley on the machine must make 144 revolutions per minute. It is driven by a pulley 9 inches diameter; now, applying formula (1), we have

$$12 \times 144 = 9 \times r.$$

Now, anyone acquainted with ordinary arithmetic will readily see that in order to find the value of r we simply proceed as follows:

$$\frac{12 \times 144}{9} = r = 192;$$

that is, the countershaft will have to make 192 revolutions per minute. The driven pulley on this countershaft is 10 inches diameter, and the main line shaft has to make 175 revolutions per minute; hence, applying formula (1), we have

$$D \times 175 = 10 \times 192,$$

from which we get

$$\frac{10 \times 192}{175} = D = 10.97 \text{ inches}$$

for the diameter of the pulley on the main line shaft.

Business Specials.

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Gear Wheels, Gear Cutting. Grant; see page 932.

Forming Lathes, Mer. Mach. Tool Co., Meriden, Ct.

Milling Machs. Kempsmith Co., Milwaukee, Wis.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

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Squaring and Rotary Shears, Tinsmiths' Tools, Presses and Dies for sheet metal work, are made by the Niagara Stamping and Tool Co., Buffalo, N.Y.

Improved Duplex and Special Gear Cutters in stock and to order; Gear and Milling Cutters of all descriptions. R. M. Clough, Tolland, Conn.

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"Hawkins' Aids to Engineers' Examinations, with Questions and Answers," $2 postpaid. Catalog free. Theo. Audel & Co., 91 Liberty St., N. Y.

Thin emery wheels, for cutting slots, etc., a specialty. The Tanite Co., Stroudsburg, Pa.; 161 Washington street, New York; 139 East Pearl street, Cincinnati, Ohio.

"Practical Drawing," by J. G. A. Meyer; used by engineering schools in lieu of text-book; the set of 92 papers sent to any address in the United States for $5. AMERICAN MACHINIST, 203 Broadway.

Modern Furnace vs. Cupola Practice—IV.

BY THOS. D. WEST.

MOLDING AND CASTING PIG IRON.

The many wrinkles which are employed by the furnaceman in controlling the distribution of twenty to one hundred tons of molten metal, which when once let loose from the furnace cannot be stopped, display experience and knowledge which the foundry manager and molder can often well utilize in founding. Every branch of handling molten metal has its own little tricks in practice which often have taken years to perfect, and I propose to now illustrate some of those involved in controlling metal and making casts at a blast furnace.

A molder, however well experienced, that has never seen a blast furnace, would be very liable to make a nice mess of things at the start, should he attempt without any instruction to direct the making and casting off of a floor of pigs. In preparing a molding bed for making pigs, the floor is dug out from three to four feet deep, and then filled up with a medium grade of bank sand of a very open, sandy nature. The reasons for going down to such a depth to simply mold a few pigs that are not over four inches deep, and also for using such a coarse grade of sand having very little binding qualities about it, are the desirability of having conditions as favorable as possible to permit the escape of steam from any excess of moisture or water which the sand may contain, or drain such downward, and hence lessen the chances of a "boil." The molder must bear in mind that when once a stream of iron is started it cannot be stopped to plug up a "run out" or dampen the ardor of a little "kick," the same as when pouring a mold, and hence the precaution to not be dependent upon judgment in getting sand just the

right "temper." Where sand is as open as is generally used for pig beds, and as deep in the floor as above described, water, after having been absorbed to a certain point, will, to a large degree, filter through coarse sand towards the bottom of its depth, so that should an excess of water have been used, the chances are it will not cause a "boil," as it would certainly do if the sand was of a character like that generally used for green sand molding in a foundry. Another point which makes it desirable to use such open-grained sand is that of saving labor in mixing sands. About all the mixing that furnace sand generally gets is what the force of water from a two-inch nozzle gives it. I have seen such a stream play steadily on one spot for two or three minutes and no attention paid to it. If molding sand in a foundry received such abuse the iron would mostly go to the roof, the moment it struck the sand. But like all else in mechanics, there is a limit for abuse and too much carelessness in wetting down the floor of a casting house can result in disastrous "boils."

Molding pigs is generally performed by three men, who will mold up fifteen to twenty beds in about one hour. The main runner leading to the pigs Nos. 1, 2, 3, 4, 5, 6 and 7, Fig. 15, is called the "sow runner." There are generally from 24 to 28 pigs to a sow. Each sow is leveled, likewise the pigs connected to it, but each bed is, still, require dynamite to break it up sufficiently small to be charged into the furnace along with the ore, or sold for scrap metal to be re-melted in air furnaces or big cupola.

The making of the iron runner is generally the work of the "keeper." Figs. 10, 11, 13 and 14 show different views of such runners, and Fig. 20 a perspective view of the whole.

After a furnace has been tapped the metal often comes slow. To prevent it from chilling until its speed is sufficient to fill the runner as desirable, a little knoll, as at *A*, Fig. 10, is generally formed in the "iron runner," as shown. This causes sufficient body of metal to be collected to keep itself fluid until the flow is increased sufficiently to overflow the knoll, by which time the chances are the flow will have enlarged itself to the degree of sending a fair stream down the iron runner. The iron in first flowing down the runner carries more or less slush of iron and dirt in the front of its stream. This will often pile up so as to require to be broken by means of a wooden pole in the hands of a man, as seen in Fig. 20, as soon as the metal has reached and filled the lower bed; a "cutter," as shown at is only "pigs" that are being molded and cast. As the metal flows down the runner much of the sand mixes with the iron, but as pigs are not finished or condemned, if they are a little rough from dross or sand, there are no serious objections to a little sand flowing with the iron as long as it is not sufficient to impede its passage to the pigs. At *H*, Fig. 15, is seen the "ravel" as it is placed in the sand ready to make an opening to admit the molten metal from the main runner to the sow.

At Fig. 17 is shown what is called "runner staples," and which are used to support the "cutters" as seen at Nos. 1, 2, 3, 4, 5 and 6, Figs. 10 and 14; also in the perspective view of the main runner seen in Fig. 20. As each pig bed fills up the cutters stop the flow of metal, admitting it to flow into the adjoining bed as above described. When half of the beds are about poured off, slag then commences to come out with the iron at the notch hole. To prevent the slag from passing down the runner to the pig beds, a "skimmer plate" seen at *I*, Fig. 10, is knocked down to about the depth shown and then some sand is thrown against it on the side at *K*. By ramming this sand the opening below the lower edge of the skimmer plate *I* and the bottom of the runner can be decreased at will, so that only iron may pass beyond the skimmer plate and its flow may be regulated. The slag is let run out at the "slag runner" shown at the dotted lines *K*, Fig. 10. The slag running out at the tap hole at every cast is considerable, often for forty tons of iron there may be four tons of slag. After the pigs are cast they must be broken. This constitutes the most laborious work about a furnace. Before starting to break the pigs, which is not done until they have solidified sufficient to not "bleed," sand to a depth of about ¼ inch is thrown over their surface. Two to three men wearing wooden soles about 1½ inches thick attached to their shoes now start at the first poured bed with pointed 1¼-inch bars about six feet long. By inserting the point of the bar between the pigs at the end furthest from the "sow," they are readily broken loose from the sow. After the pigs are all separated the sow is then broken by means of taking the ends of the pigs of the next row as a rest to pry the sow up which if not broken, from being lifted, a sledge is then used. When two to three men will separate about five hundred pigs and break about eighteen sows in several pieces in about a half hour's time and not seem in any hurry, it is safe to conclude the work is down to a very commendable system. After the pigs and sows are all broken as above described a stream of water is turned on to cool them off so that they can be handled and removed from the casting house in time to permit the bed to be re-molded for its next turn in casting. This, in a furnace making five taps every 24 hours, leaves but about four hours for the "iron carriers" to break up and load on buggies for removal from a casting house about 40 tons of pig metal. To admit of a buggy being brought close to the iron to be loaded, a wooden track fastened together in sections of about 10 feet long is laid down on the casting floor to any length or turn desired.

There are always two floors to a casting house so as to permit one being molded and got ready for a casting while the other is being relieved of its pig metal and wet down ready for molding. There has of late been a patent taken out for a device which will pick up all the pigs with its sow and run them bodily on a traveling crane out of a casting house to a machine which will break the pigs in two pieces as well as the sow to any length desired, but for some reason furnaces do not seem in a hurry to adopt it.

As a labor-saving device, casting pigs in "chills" or an iron mold is sometimes practiced, but I do not know of any furnace using them at the present time in the United States. There are several objections to iron molds for casting pigs in. The first is that of the chill such molds impart to pig metal. But to this evil there is not so much objection to be raised at the present day when iron is sold on chemical analysis as when it was judged wholly by its fracture or the grain which the iron presented, as chilling an iron cannot make its chemical composition any different when re-melted except in one respect, and that is in causing pig-iron to be slightly higher in sulphur than if it was cast in sand, owing to the metal permitting sulphur to escape when long in a fluid state, a factor largely proven by the fact that the top half of a pig will often contain more sulphur than the bottom portion or that part cast down.

The second objection to iron molds lies in their liability to crack or warp from the application of the water used to cool the pigs off so that they may be carried away in season to prepare the iron molds for their next cast. This labor is about equal to molding the pigs in sand, as the iron molds generally require to be grouted or washed over with a coat of thick clay wash. Since the furnaces have got on to the wrinkle of using coarse grades of sand and making their floors deep so that water will readily pass from the surface to the bottom without leaving the sand to be used for molding as so much mud, the "iron mold" has practically nothing to recommend its adoption.

At Fig. 20 is seen a perspective view of a casting house as they generally appear about one-half hour before casting time. The keeper seen standing by the notch of the furnace has got his runner all made with the runner staples and cutters placed in position. The man on the right at the lower end of the runner is shown just finishing ramming the last bed of pigs. To afford an idea of casting, the first man on the left of the main runner is shown standing ready to drive the cutter into the runner to stop the metal from flowing to the first bed. The second man seen on the left stands ready to ravel out the branch runner to the pig bed. The third man having a pole in his hand, is supposed to be breaking up the crust of slush formed in the front of the metal as it first comes down the main runner. These three last men are simply placed in position shown to illustrate their work if the metal had been actually running down the runner as above described. To those never having seen a casting house, Fig. 20 should give a good general idea of the methods employed for molding and casting pig metal.

It is no uncommon thing for molders to be employed at a furnace to make molds, open and closed, to be poured with metal as

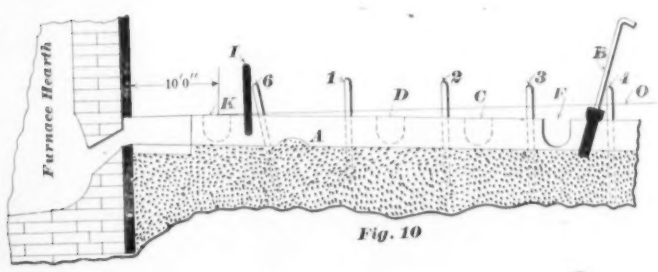


Fig. 10

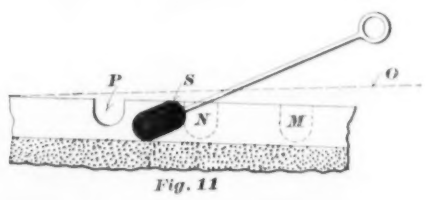


Fig. 11

Fig. 12

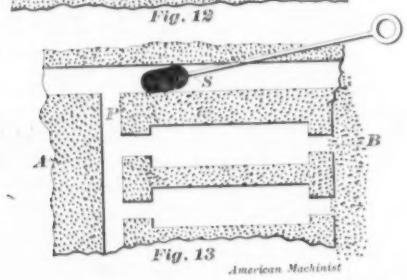


Fig. 13

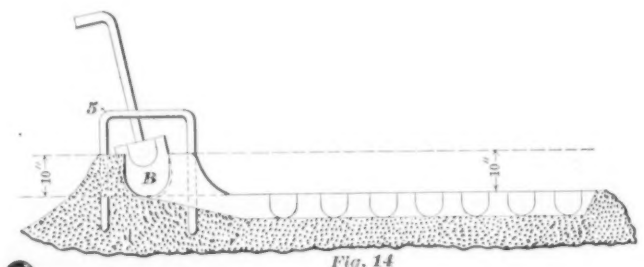


Fig. 14

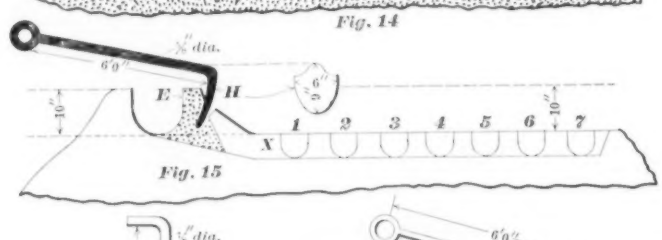


Fig. 15

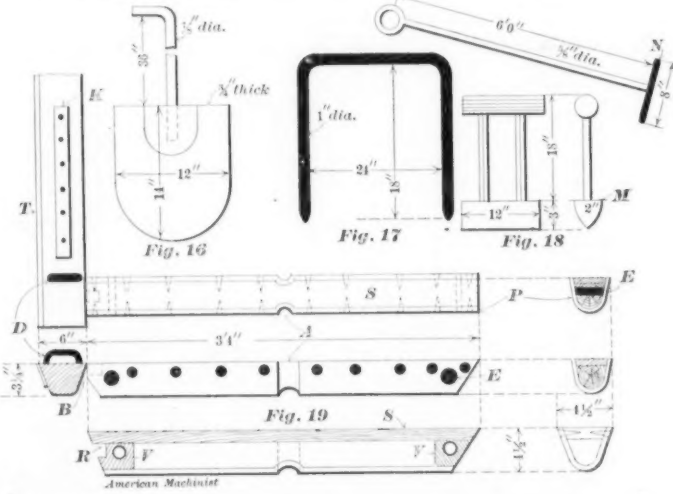


Fig. 16 Fig. 17 Fig. 18

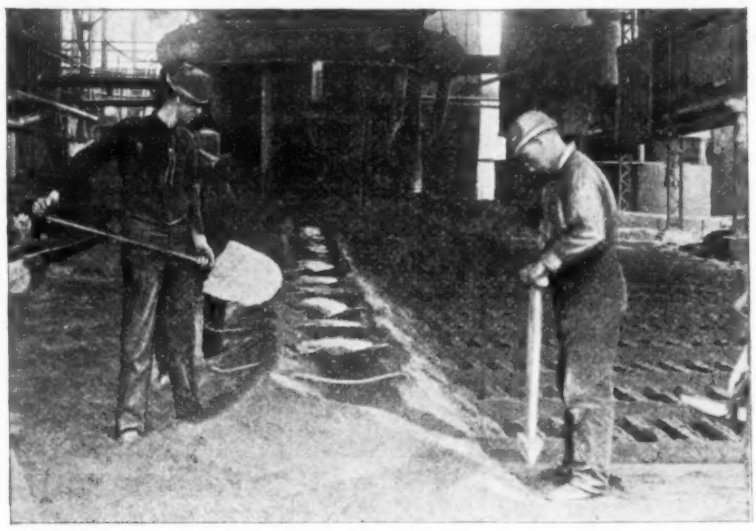
Fig. 19

American Machinist

FURNACE PRACTICE.

in commencing from the lower end, made one or two inches higher as they approach the last bed, so as to conform closely to the incline of the main or "iron runner," as generally called, and which has a fall of about eighteen inches in one hundred feet. Any more fall than this would generally cause the iron to flow with too much of a rush, and should it get away from the furnace any faster than usual, the chances are it could not be controlled, and instead of its being distributed as desired throughout all the pig beds, the lower two or three beds would be overflowed, and a "boil" easily started by reason of a large area of floor space being all covered with a plate of fluid metal, permitting no escape of gas and steam from the sand cores between the pigs. The founder often receives pigs united together, and often much thicker in depth than usual. These are called jump cores, and are so formed by reason of the body of sand in the mold separating the pigs being raised or pressed to one side by the action of too quick a flow, poor sand, or a little "boil." It is no uncommon occurrence for metal to come so fast down the iron runner that it cannot be controlled, and by reason of covering over a large area, can cause a whole tap to go under the drop, or, worse Fig. 16, and in the hands of the man at the right in Fig. 18, is then quickly placed with pressure so as to be bedded into the main runner, as seen at *B*, Fig. 10. A few moments before this is done a man with a ravel, as seen at Fig. 20, pulls away the mound of sand, closing the connection from the "iron runner" to the "sow," as seen at *C* and *D*, Fig. 10; also at *E*, Fig. 15, to make an opening, as seen at *F*, Fig. 10. The top level of the pig beds should be below the level of the bottom of the main runner in order that all the metal will drain itself out of the main runner, and, again, the pig beds should not be too far below the level of the bottom of the main runner, as this would cause the metal to rush from the main runner to the sow with a force very liable to cut up the sand where the metal would strike the bottom level, or wash away the cores between the pigs. The distance sought for is about that shown in the cuts, Figs. 14 and 15. If the molder would consider trying to make a mold with what is generally termed a medium grade of bank sand, having the life pretty well burned out of it, he will then be in a position to understand how easily a rush of metal could cut up a pig bed of molds, and the necessity for having certain conditions prevail, even if it

it comes down the main runner. To regulate the flow so as to stop it as soon as the mold is filled is a trick often worth knowing for application even in a foundry. At Fig. 12 is seen a section, through *A B* of Fig. 13. The molds shown are supposed to be "open sand" plates, which are wanted as uniform in thickness as possible. By the plan shown, if the metal is as hot as is generally obtained, the plates can be made to not vary over $\frac{1}{8}$ inch in thickness, which is as close as a founder can generally run them where he has metal in a ladle supposed to be under perfect control. In explaining this wrinkle, attention is first called to Fig. 11, which is a section of the main runner. At the dotted lines *N* and *M* is seen the depth which the branch runners connecting the sow and main runner are generally made and which are



PIG FLOOR.—FIG. 20.

supposed to drain all the metal from the main runner until "cut off" by the "cutters" *B*, as seen in Figs. 10 and 14. By making a comparison in the depth of the opening *P* with *M* and *N* it will be seen that the opening at *P* could not deliver any metal unless the iron was raised in the runner to its level, and the chances are in the general working that the iron in the main runner might never reach the bottom of the opening at *P*. But to compel it to do so, a stopper composed of slag chilled on the end of a one-inch iron rod, as seen at *S*, Figs. 11 and 13, is placed in the main runner to impede the flow of the metal. This action raises the hight of the metal in the runner so as to make it flow out at *P*, and the moment the stopper *S* is lifted, the metal is lowered below the level of this outlet, and hence instantly ceases to flow in to any mold which may be run by such a plan. This last wrinkle well governs the actions of the main runner in filling molds, but there is still another point to guard against where two or more castings are poured from such a branch runner, and this is the tendency of one mold to fill before another, and hence furnish castings thicker or thinner than might be desired. To regulate this point, a portion of the edge of the mold is cut away to the thickness desired, as seen at *B* in the plan view, Fig. 13, and also in the section *A B*, Fig. 12. Such molds being generally raised above the level of the floor, it can be readily conceived that any overflow at the points *B* will be received at a lower level than that of the castings, hence the difficulty with good metal of obtaining such castings thicker than they might be desired. It may be well to state that outlets, such as at *P*, should be made well up towards the upper end of the main runner, so that when the stopper *S* is lifted, the metal will then have a chance to run on down the runner to fill the pig beds through lower outlets, as at *N* and *M*. The dotted lines *O O*, in Figs. 10 and 11, are supposed to be level, and the angle of the main runner shows the incline from this level line.

At *T*, Fig. 19, is shown a plan of the pattern. The recess at *A* is to assist the pigs being broken in two pieces when cold, and the formation as seen at *B* where the pig and sow join makes their separation at this point easy when breaking the iron after a cast. The same number of patterns are used as there are pigs to be molded in a bed. A good method of forming these patterns is by a combination of sheet steel and wood. The steel which forms the outside as shown by the heavy black line at *D* is about $\frac{5}{32}$ inch thick, and formed to shape over an iron block before the wood is secured, as shown at *D D* and at *E*, the latter being a 1¼ inch piece of hard wood secured by wood screws passing through the steel at the upper edge every 4 inches into the wooden board. To secure the pattern at its end, a 1¼-inch rod passes clear through each end and is riveted. This method makes a very light pattern, and one which will last for years, and discounts a dozen times over the old plan of making all wooden patterns, which is still used by some. The principle involved in the construction of these patterns is one the founder and patternmaker might often well utilize. The sow pattern is made of a continuous stick of timber having one side at *H* faced with a sheet of ¼-inch steel, so as to retard warping of the pattern There is also a piece of iron ½″x2″ set in and screwed down on the top surface of the sow pattern, as seen at *K*, for the purpose of leveling; as constant friction of a level on the surface of wood would cause it to splinter and be uneven for leveling purposes. In using these patterns and bedding them in the floor, there is no heavy sledge hammer used to settle them as a molder generally does with his patterns. In fact, no sledge or hammer is used on them, the only thing leveled is the sow; if one end is high, the pattern may be lifted and sand scraped away from under it, or the low end may be raised and sand tucked under it by means of the handle end of the shovel or a lick of the foot. The sow having been leveled, the pig patterns are then laid down on the floor which has previously been leveled off with a shovel as near as the eye can judge, and which is generally done truer than many of our molders are capable of doing. When the patterns are all in place, sand riddled through the shovel fills up the space between them, and a man with a rammer 12 inches long, as seen at the right, in Fig. 20, rams the sand between the patterns. After going over with this rammer once, sand is then shoveled over the bed, and a flat scraper 18 inches long scrapes the sand off level with the top surface of the patterns which is all the packing or sleeking the surface or joint of the bed receives. Sand having been pushed with the back of the scraper to raise a mound of sand between the pig beds to prevent metal flowing over, the sow pattern is now drawn out by means of the lifting iron, seen at *P*, Fig. 19. The sow having been removed, the pig patterns are then drawn out by first raising one end with the hand in the recess at the end *R* until they can be lifted by the center when they are tossed onto the next bed ready to be set up for another filling of sand. Some molders might feel like asking, "Was there no swab used?" No, the wetting the joint receives is as if by chance the fellow on the other side of the house wetting down the floor, should in turning himself carelessly throw a stream of water over the joint. I do not wish to be understood as saying that because pig beds can be made with such apparent rapidity and little labor that the molder should do the same in making "open sand" work in a foundry, but nevertheless the principles involved should be studied by those molders that must have a whole day to make about a dozen gaggers. Any molders that cannot make gaggers without the use of a level had better take a week off to practice making and judging of ground levels.

Modern molding and casting of pig metal involves points which the founder can often well utilize. The principles involved in using open grades of sand and having deep floors to afford a chance for excessive moisture or water to pass downward, is one the founder having much "open sand" work to do can often well adopt. How often do we find molders making "open sand" work that will "kick" and "bubble" in such a manner that when the castings come out it is a conundrum whether they came from a foundry or a furnace "boil." Drop close grades of molding sand and adopt a sharp open sand and use regular molding sand only where the metal from the pouring basin strikes the flat surface of the mold, and the trouble as above described with "open sand" work in a foundry will decrease.

If good "open sand" castings can be made at a furnace they surely should at a foundry, as the molten metal one place is in a sense the same as another. It is no uncommon thing for us in our foundry to make small castings with metal, carried by three men in a "bull ladle" taken from the furnace. It is only about three weeks ago that a hollow piston in a 14-inch cylinder which drives our fan had both ends pulled out. It was a piston that should never have been sent out of the shop that made the engine, as its faces had been turned down so that there was only about a quarter inch thickness of metal over the core, and half of this was full of blow holes that had been plugged. The accident occurred at 3 o'clock in the afternoon and by that evening we had a new hollow piston poured with the furnace iron. As we had about a thousand feet to carry the metal, it was necessary to have it as hot as possible when it reached the foundry. The plan which we adopt in obtaining such small bodies of metal is simply to catch the iron with a "hand ladle" by dipping the iron out of the main runner and pouring it into a "bull ladle." We have made very good small castings by such a plan. We have also taken "direct metal" in crane ladles, but how and with what success requires more space to explain than could be given at this writing.

Fifty-Ton Reversed Cylinder Forging Press.

We illustrate herewith a forging press designed to exert a working pressure of fifty tons with water at 2,500 pounds pressure and with a capacity for 75 tons if corresponding increase of service is provided.

The opening between the platens is 16 inches, and T-slots provide for the ready attachment of dies and fixtures. The movement of the upper platen is 6 inches. It is guided on the rods and is raised quickly by the automatic return cylinder, which is mounted on top of the cylinder and kept in connection with the accumulator. The press is mounted on a stand, which brings the platen about 32 inches from the bottom.

The motion of the machine is controlled by a ¾ inch balanced spindle valve.

Extreme hight of machine, 8 feet 6 inches; floor space, 15 inches by 36 inches to outside of valves.

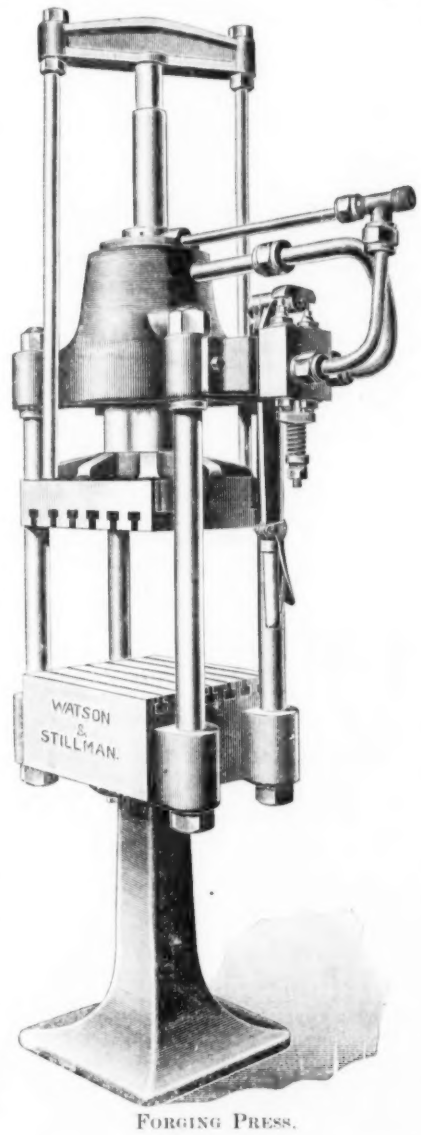
It is made by the W. & S. Hydraulic Machinery Works, 207 East Forty-third street, New York.

Another Fly Wheel Bursts.

A fly wheel burst in the power house of the Albany, N. Y., Railway Company on the afternoon of November 12th. No one in the house was hurt, but two buildings, one of them two blocks away, were wrecked, and four men in a saloon opposite were severely injured, one of them dying in an hour or two. The engine was a horizontal Corliss of 750 horse-power. At this writing nothing is known of the cause of the accident.

A Perplexed Investigator.

M. Chatelier had a surprise the other day. From the scanty details which reach us we are not quite sure whether he is working for the Philosopher's Stone, the transmutation of metals, or some other subtle effect in alchemy, or he might have been simply working for a new self-lubricating metal to take the place of Mr. Babbitt or Bull's composition. But whatever the result he wished for, he obtained one which caused him to put both hands in his pockets, purse up his lips and ejaculate a long, low whistle in two flats. For hours afterwards he was to be seen pacing slowly back and fro, shrugging sometimes one shoulder and then the other, and sucking air shrilly through his lips. Finally he confided to his confidential assistant that it made him feel real devilish. What bothered M. Chatelier was this: He had made a favorite ingot according to a receipt of his own, of equal parts of aluminum and copper. By accident or design this specially prepared and delectable ingot was placed to soak in a solution of common salt and lead chloride, where it remained some 24 hours. When it was fished out of the pickle, it looked and acted for a few minutes precisely as it did before. Twelve hours' exposure to the air, however, proved too much for the nerves of the ingot,



FORGING PRESS.

and the whole mass became reduced to powder by spontaneous oxidation, or combustion, or some mysterious process of the sort. This is what set M. Chatelier to whistling and walking about, shrugging his shoulders, with his hands in his trouser pockets.—*Invention* (London).

The firm of John Wedderburn & Co., Washington, D. C., who are solicitors of patents, have adopted a rather novel plan of paying each month a prize of $150 to the

inventor who has the best and most useful patent taken out through their agency during the month. Last month this prize was awarded to Mr. D. F. Cornell, of Westfield, Pa., for an improvement in lathe carriages.

If you feel within yourself a desire to expand your usefulness in behalf of the machine interest of this country, if you are a bright, aggressive man who can tell his story to advantage and address business men—in short, if you think it possible to earn more money, write or call on the Treasurer of the AMERICAN MACHINIST, and he will show and explain a method which might make you a more useful man and add largely to your income.

Literary Notes.

ROPE DRIVING. A Treatise on the Transmission of Power by Means of Fibrous Ropes. By John J. Flather, Ph. B., M. M. E., Professor of Mechanical Engineering, Purdue University. First Edition.

This work treats of a topic upon which more should be known and more generally known than at present. While the system general in the United States of doing the main driving in mills and factories by means of flat belting is unquestionably superior to the English practice of driving by gearing, our transatlantic friends have now leaped beyond us, and the last quarter of a century has seen rope driving widely adopted in the textile industries of Great Britain, with the conceded advantages of steadier running, and an increased output. Rope driving is also now rapidly on the increase with us, the American system generally employing a continuous rope, while in England the multiple ropes are more common. The advantage of the rope drive for distances exceeding 200 or 300 feet disappears before the advance of electricity. Ropes are not as short lived as many think them, the use of the same rope for a dozen years being not uncommon under good conditions. The larger sizes are always to be preferred where practicable, less than 1 inch, or at the least ¾ inch, not being favored. If two ropes are used a stoppage on account of the giving out of either of them is quite unlikely, as the other rope could almost invariably do the driving until the opportunity came to replace the first one.

The work before us gives very thorough information of the most practical kind upon the whole subject of rope driving, and matters connected with it. Included in the work are 22 tables and 92 illustrations, 237 pages. Published by John Wiley & Sons, New York. Price $2.

In these days no sooner does any new thing appear than there appears also a trade paper devoted to that thing. We have or did have a journal devoted especially to aluminum, and if putty were now a new discovery we should undoubtedly have *The Putty Times* or the *Journal of Putty*. The latest candidate for public favor is called *The Motocycle*. It is published in Chicago by the Motocycle Publishing Co. It will be devoted exclusively to road vehicles driven by motors.

COMMERCIAL REVIEW.

The Machinery Trade.

NEW YORK, Monday, Nov. 18, 1895.

Although, as compared with a year ago, business in the standard lines of machine tools shows marked improvement, it has dragged rather heavily through the summer, and is now moving but slowly toward a better situation. Still, its tendency is in the right direction, and a more buoyant feeling exists than hitherto. Prices have not kept pace with the cost of labor and raw materials, but there has been some advancement. After the quiet summer, they are as high or higher than last spring, and rule steady, with a slight inclination to rise.

Demand has been lively for tools for bicycle manufacture, especially screw machines, the supply being, in some cases, several months behind-hand. It is reported, however, that within the last two weeks this branch of trade has become a little less brisk, while the call for general machine tools has been increasing. The lighter lathes used for locomotive work are in fairly good requisition. Second-hand machines find a ready market. The movement of trade in small machine shop supplies, such as files, has been very different from that in power machinery. After a spasm of activity which took place a few weeks since, there has been a gradual quieting down of business. Woodworking machinery is stagnated in New York and vicinity, but conditions are more favorable in Boston and in the West. It is found more economical to manufacture sashes, doors, etc., in large quantities in the West and ship them to New York, than to transport the rough lumber and work it up here.

In power transmitting machinery there is a fair business doing, but prices are stationary at a low level. When raw materials were selling at low rates, manufacturers stocked up, and having now about exhausted their supplies, must soon purchase more, and advance their prices. As regards leather belting, this rose 20 per cent., when, earlier in the year, hides went up 50 per cent. The latter have fallen back 10 per cent., but belting has held its own, and with leather becoming scarcer, dealers do not fear a decline. A seller of railway contractors' supplies reports a quiet domestic, but fair export trade, with prices tending toward rock bottom.

Engines, Boilers and Pumps.

The engine trade shows a moderate demand. Export features are among the most hopeful, though the Spanish American market is for the present about closed. At home there is a call for engines for large office buildings and manufacturing establishments; but this being a season when factories should have the essential parts of their equipment ready for actual work, it is not to be expected that such installations will at present become more frequent. Competition is so sharp that prices are kept down, another depressing influence being the tendency of buyers to choose cheap articles, even though somewhat inferior. For large, high-speed electric light engines, the demand is now slackening, November being naturally a quiet month. Corliss engines are reported to be in steady selling.

The tone of boilers seems better than that of engines; prices, when they leave the level, choosing an up grade. At home, boilers are needed largely for steam heating plants, and, as is the case with engines, the export trade is no inconsiderable feature. Large fields are opening up in Australia and Japan. A dealer in spring safety valves reported September the best month his company had experienced, but that a slight lull in trade followed.

Steam pumps have advanced, and prices are now at rest. The Deane Company, which is executing a large contract for water-works at Schenectady, states that the past six weeks have been characterized by a good business; but this does not seem to have been everywhere the case.

Iron and Other Metals.

A pronounced weakness is shown by Bessemer pig. Some alarm has been felt as to whether the iron market would see a continuance of the depression that followed its summer boom. But its inherent strength is very great, and most furnaces are kept well employed filling old orders during the present cessation of new ones. Buyers seem to be holding off to test the market. After six months of heavy buying comes a six weeks' lull, and a month hence we may see again the large demand which is necessitated by large melting. Western foundry irons, in this market, are about as firm as ever. Eastern furnaces have made a cut. Now that the Frick Coke Company has absorbed the McClure and, according to report, another company also, coke is to be marked up to $2.00 per ton at the first of the year, which will probably cause some advance in iron.

Soft Bessemer steel billets are lower, but there is a firm undertone. The demand for American tool and machinery steel has slackened during the past week, but is still good from New England points, and is much better than a year ago. Last month is reported as the best of the year.

Copper is quiet, and selling is chiefly in small lots for early delivery. Stocks are being allowed to dwindle preparatory to retaking, and more business is expected after January 15th.

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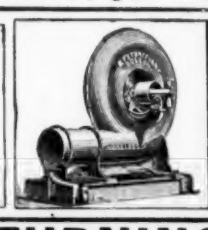
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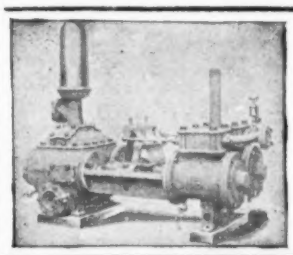
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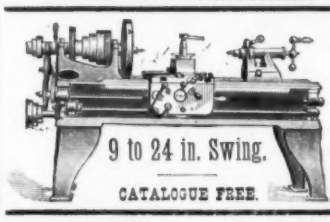

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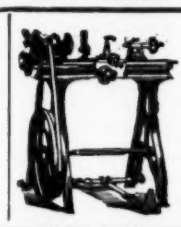
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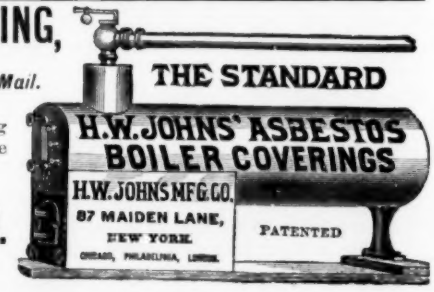

Pig tin is tame and nearly steady. Consumption by American tin-plate makers has been gradually increasing.

Lead is declining. The demand has for the last two weeks been active, but a dull season is imminent. The price is now some 30 points below Europe and dealers wonder how long it will remain so.

For spelter the demand is, at this season of the year, falling off and the market is quiet. The St. Louis price, which governs the New York, is a cent a pound lower than six weeks ago, the decline being caused by overproduction.

Antimony is steady, as usual, with dealings on rather a small scale and prices tending easier.

QUOTATIONS.

SATURDAY EVENING.

Iron—American pig:		
No. 1 X foundry, Northern	$14 00	a14 50
No. 2 X foundry, Northern		a13 50
No. 2 plain, Northern		a13 00
Gray forge, Northern		a12 00
No. 1 foundry, Southern	13 75	a14 00
No. 2 foundry, Southern		a13 75
No. 1 soft, Southern		a14 00
No. 2 soft, Southern	13 50	a13 75
No. 3 Southern	13 25	
Gray forge, Southern	12 00	a12 50

Bar Iron—Common, on dock, 1.35 a 1.40c.; refined, on dock, 1.50 a 1.60c.

Tool Steel—Ordinary sizes, standard quality, 6 a 7c.; extra grades, 11 a 12c.; special grades, 16c. and upwards.

Machinery Steel—2 a 2¼c.

Copper—Fairly steady. Lake Superior ingot, offered at 11⅛c.; electrolytic, 11 a 11¼c.; casting copper, 10⅛ a 10¾c. for ordinary stock.

Tin—For round lots, 14.55c. cash.

Lead—Common domestic, 3.17½ a 3.20c. in car load lots.

Spelter—Business moderate. Ordinary Western brands, 3.75 a 3.80c., New York delivery.

Antimony—Quiet. Cookson's, 7c.; Hallett's, 7¾ a 8c.; Japanese, 6¼ a 6⅞c.

Lard Oil—Fair inquiry. Prime City, 52 a 52½c.

NEW CATALOGS.

There are three sizes of Standard Catalogs, 9″ × 12″, 6″ × 9″ and 4½″ × 6″. We recommend the 6″ × 9″ size for machinery catalogs. When they must be larger or smaller, one of the other standard sizes should be adopted if possible.

The Buffalo Forge Co., Buffalo, N. Y., issue a pamphlet devoted to the illustration and description of a new bellows forge for boiler makers, bridge builders and for structural iron and other outdoor work. It is 7″x6¼″.

The Long & Allstatter Co., of Hamilton, Ohio, send us "Catalog No. 18," in which are a large number of fine illustrations of their extensive line of punching and shearing machinery, bending rolls, grinding machines, etc. The catalog has 88 pages, and is standard size, 6″x9″.

The Bickford Drill and Tool Co., of Cincinnati, Ohio, send us an illustrated catalog, devoted to setting forth the special merits of their various forms of drilling machines. It will be found interesting to those who have drilling to do, which, of course, includes all builders of machinery. It is standard size, 6″x9″.

The Frick Co., of Waynesboro, Pa., send us a finely illustrated and printed catalog describing their refrigerating machinery; besides being a catalog, this book contains much information of value on the class of machinery of which it treats, and it will be found a useful book to have at hand. It is standard size, 6″x9″.

The Newton Machine Tool Works, Philadelphia, Pa., send us a pamphlet in which are a number of half-tones, giving exterior and interior views of their new shops, and also of a large variety of machine tools made by them, consisting principally of milling machines of various forms and drilling and boring machines. The pamphlet is 7⅝″x4⅜″.

Mr. W. H. Mansfield, 71 Court street, New Haven, Conn., sends us a catalog in which are illustrated various lathes to be driven by foot and power. Some of these have milling attachments, and they are designed especially for amateur and experimental work. The catalog is 5½″x9″, and, of course, could easily have been standard size.

MANUFACTURES.

The Russell-Jennings Manufacturing Co. has been organized at Saybrook, Conn., with $200,000 capital stock.

The Norfolk (Va.) Creosoting Co. has been incorporated by W. W. Tunis and others, with a capital of $50,000.

The Piedmont Cotton Mill Co., of Atlanta, Ga., has been formed with a capital of $200,000. R. W. Hardemus is president.

The Ybor City (Fla.) Manufacturing Co. has been incorporated with a capital of $20,000. They will operate a saw-mill. Henry L. Crane is president.

The King-O'Hara Mfg. Co has been incorporated by P. King, Alexander P. O'Hara and Chas. E. Stanley, to manufacture bicycle supplies at Chicago Capital stock, $10,000.

The Virginia Bridge and Iron Co., of Roanoke, Va., has been organized with Samuel Walton as president and C. E. Michael secretary and treasurer. Its capital stock is $50,000.

The Pine Bluff & Western Railroad Co. has been incorporated at Little Rock, Ark., by W. X. Fuller, L. A. Dodge, J. W. Beall, Jr., of Boston, Mass., and J. A. Gaylord, of New York City, with a capital of $500,000.

The South Bend Paper Co., of South Bend, Ind., are putting in operation at Big Island, Va., a large paper and pulp mill. They are fitting up a machine shop in which to do their own repairing, and have ordered from The Lodge & Davis Machine Tool Co., of Cincinnati, Ohio, the necessary tools for same.

The Berlin Iron Bridge Co., of East Berlin, Conn., have just completed for the Somerville Woolen Mills, at Somerville, N. J., a spinning room 54 feet wide and 210 feet long, and a boiler room 40 feet wide and 216 feet long. The construction of the spinning room is steel trusses, with heavy plank floors and roof. The boiler room is constructed with brick walls, steel trusses and corrugated steel covering, making it absolutely fire-proof.

The Deane Steam Pump Company is constructing for a large water works plant at Schenectady two high duty pumping engines of 6,000,000 gallons per day capacity each, and for the Andover (Mass.) Water Works an engine of 1,500,000 capacity. The same company has taken a contract to furnish the pumps, nine in all, for the new Manhattan Hotel, Forty-second street and Madison avenue, New York.

The Link-Belt Machinery Co., Chicago, are still running their works day and night, using the largest force ever employed by them. Recent contracts

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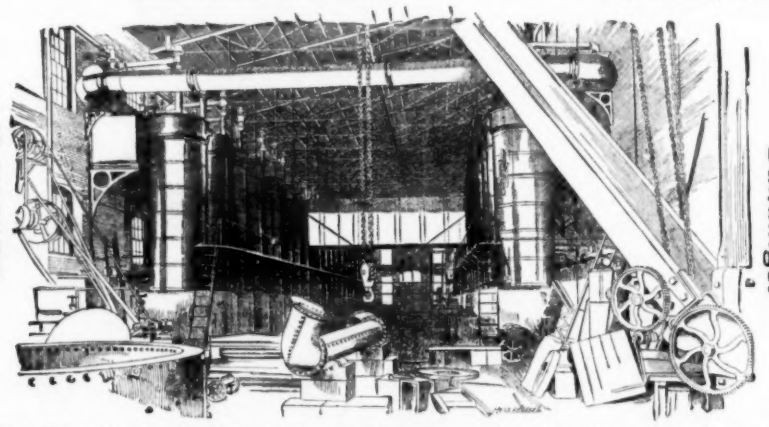
Engineers, Architects and Builders of Iron and Steel Bridges and Buildings.



The above illustration is taken direct from a photograph, and shows the interior of a Boiler House the roof of which was designed and built by us for the Amoskeag Mfg. Co., at Manchester, N. H. The building is 75 feet in width by 275 feet in length, the walls being made of brick, and the roof being made of iron—iron trusses, iron purlins—and covered with corrugated iron, so that there is absolutely no woodwork anywhere about the building which can take fire. For boiler rooms this construction particularly commends itself.

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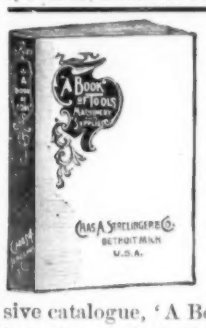

"There is but one suggestion we might make—and our desire to criticise would impel us to make more—if we could find anything to make criticisms about, and that is instead of calling this most neat, complete and comprehensive catalogue, 'A Book of Tools,' it should have been called *The* Book of Tools, for it has no equal."

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"A Book of Tools" is our catalogue. It contains 550 pages, upwards of 2,000 illustrations, and will be sent post paid to any address upon receipt of 25 cents in stamps.

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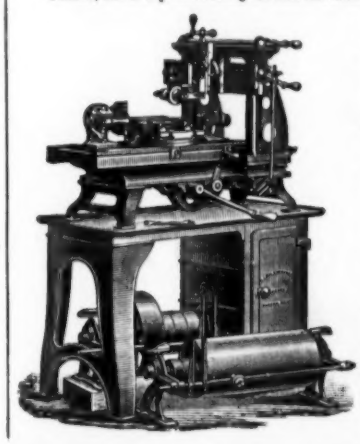

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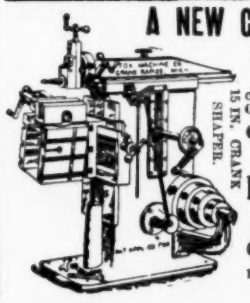

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"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

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whose names appear on our **subscription** list, this paper will give two free insertions under this heading to those in want of positions. The advertisement to occupy a space of not more than five lines. Additional space or insertions must be paid for in advance at regular rates.

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Wanted—Position by draftsman, technical graduate with shop experience. S. C., Am. Machinist.

Wanted—Patternmaker thoroughly experienced in machine tool work; perm't pos. to right man. Hoffman Mach. Co., Amsterdam Av. & 143d St., N.Y.

Wanted—A first-class expert in gilding, plating, etc.; experienced in electrotyping in relief; best references. Address T. J., 100, American Machinist.

Mech. engineer and draftsman of highest qualification, had charge of shops and office before, wants resp. position. Address Box 217, Baltimore, Md.

Wanted—Pos. as salesman or assist. supt. by young man; 4 yrs. shop, 5 yrs. drawing-room experience; light and heavy mach'y. Business, Am. Mach.

Wanted—Fifty first-class tool makers, screw machine hands and die sinkers, familiar with gun and bicycle work. Remington Arms Co., Ilion, N. Y.

Mechanical engineer, graduate from A1 German school, exp'd as mach. and mechanical draftsman, wants position as assistant in shop or drafting department. Paul M. Wenner, 175 East 60th St., City.

Wanted—Position as floor hand on engine, pump, or air compressor work, by educated machinist; American, aged 29; 10 years' experience; Middle States; references. "Floor," care Am. Machinist.

Wanted—2 or 3 1st class general machinists on light tool making, small aut. machinery, jigs, fixtures, etc.; state age, experience, and wages expected. Address Mass, American Machinist.

Position desired by man who has had fourteen years' experience as head draftsman and superintendent of machine shop and foundry; can control considerable trade for castings and tool work. A. E. M., care American Machinist.

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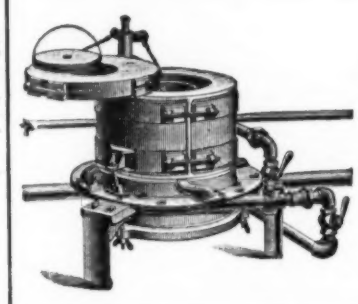
(*Continued on Page* 935.)



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36" Gould & Eberhardt Gear Cutter.
26" Pratt & Whitney Chucking Lathe.
60" Triple-geared New Haven Lathe, with chuck jaws.
40" New Haven Back-geared and Power-feed Drill.
32" Double-head Pond Planer.
No. 1 Giant Key Seater.

Send for complete list. Send for catalogue of Bicycle machinery.

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2 10 in. x 5 ft. Foot & Power.
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1 15 in. x 6 ft. Dustin.
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1 30 in. x 14 ft. Lincoln.
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PLANERS.

3 48 in. x 32 in. x 6 ft. Pond, two heads.
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3 24 in. x 24 in. x 6 ft. W & L., one head.
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3 22 in. Back Geared.
2 25 in. " & P. F., Snyder.
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1 No. 1 B. & Sharpe.
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9 in., 12 in., 13 in., 15 in., 20 in.

MISCELLANEOUS.

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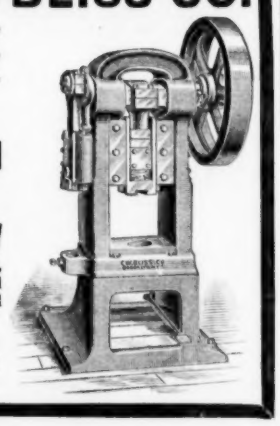

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16 x 8 Blaisdell, Plain Rest.
18 x 10 Flather, Plain Rest.
18 x 10 Blaisdell, Plain Rest.
28 x 20 Perkins, Compound Rest.
37 x 14, maker unknown.

PLANERS.

16 in. x 16 in. x 4 ft. Hendey.
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10 in. Juengst, Crank.
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10 in. Wood and Light, Traverse Head.
18 in. Putnam, Traverse Head.
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10 in. x 41 in. Garvin.
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24 in. Barnes Water Tool Grinder
No. 2 Springfield Water Tool Grinder.
No. 4 Springfield Water Tool Grinder.
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No. 2 National Bolt Cutter.
60 in. Lincoln Gear Cutter.
26 in. Pulley Lathe.
50 in. Pulley Lathe.
5 in. Cutting-off Machine.
No. 1 Garvin Screw Machine.
36 in. Bliss Power Squaring Shear.
No. 2 C. Worcester Drill Grinder.
24 in. Squaring Shear.
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225 lb. Pierce & Noble Drop Press.
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No. 31 Eaton Cutting and Drawing Press.
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Also, a large list of other machines. Write for complete list, detailed description and prices.

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" " Fay & Scott, 36x18 ft., Compound Rest, Cross Feed.
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" " Union, 72 x 20 ft., Triple Geared, Screw Feed.
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" Gould & Eberhardt, 26 in. x 8 ft. A 1.
" Pond, 32 in. x 8 ft. Good order.
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" Gray, 48 x 12 ft., Spiral Geared, Improved A 1.
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" Crank 12 in. stroke, "Pond's."
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" Gould & Eberhardt 15 in. Crank Motion.
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" Hendey 24 in. Friction. Good order
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" Hamilton 28 in., Back Gears, Automatic Feed.
" Pond 32 in. Extra Heavy, Back Gears, Automatic Feed.
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26 " 20 " " "
37 " 30 " " "
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19-36 and 50 in. Drills.
Portable Drill.
36 in. x 14 ft. Planer.
12 in. Shaper Traverse Head.
Gear Cutter, 54 in.
Milling Machine.

10 ft.-16 ft. Vertical Boring and Turning Mill, Cranes, Blower, Boiler Rolls, Punch and Shear, etc.

Send for full list and prices.

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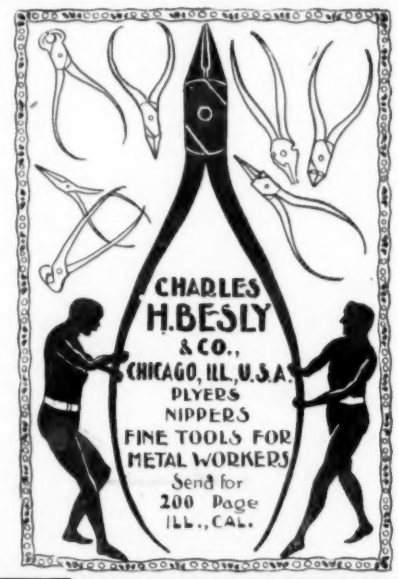

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16 in. F. B. Miles Slotting Machine.
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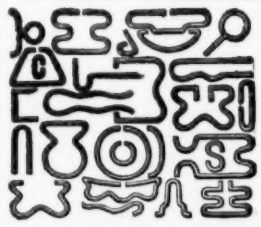
30 in. by 27 ft. Pratt & Whitney Engine Lathe.
Horizontal or Floor Boring Machine, Pratt & Whitney.
Two (2) 5 ft. Universal Radial Drills.
21 in. x 11 ft. Pratt & Whitney Engine Lathe, Hollow Spindle.
19 in. x 8 ft. Pratt & Whitney Engine Lathe, Hollow Spindle.
26 in. x 8 ft. Pond Machine Tool Co. Engine Lathe.
19 in. x 12 ft. Pratt & Whitney Engine Lathe, Hollow Spindle.
22 in. x 12 ft. Pratt & Whitney Engine Lathe, Hollow Spindle.
40 in. Bement Vertical Drilling Machine.
24 in. Pratt & Whitney Vertical Drilling Machine.

GEORGE PLACE MACHINE CO.,
145 Broadway & 86 Liberty St., New York.



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For all Anti-Friction Purposes.

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OF EVERY DESCRIPTION.

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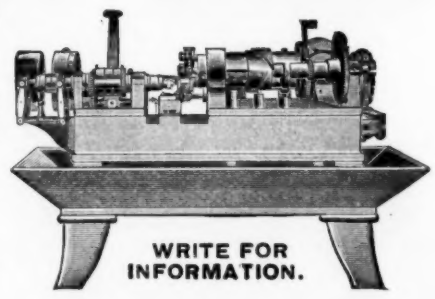

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Wanted—Foreman in machine shop; working about twenty hands on engine and job work; must be a good mechanic and understand how to get out good work at moderate cost; one who has good executive ability and push. Address, stating age, experience and price, Western Penna, AMERICAN MACHINIST.

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Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

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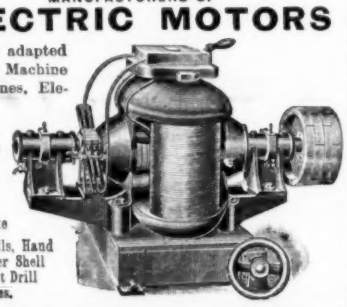

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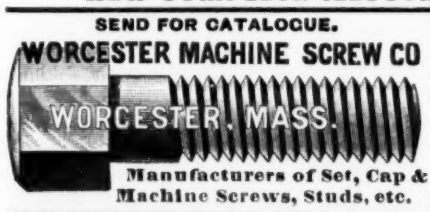

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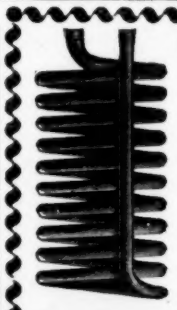

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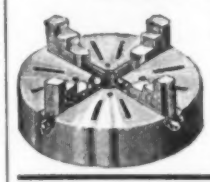

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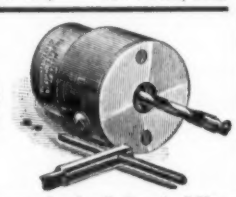

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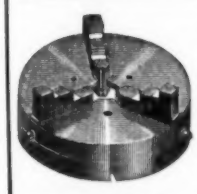

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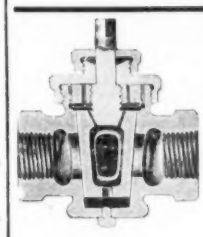

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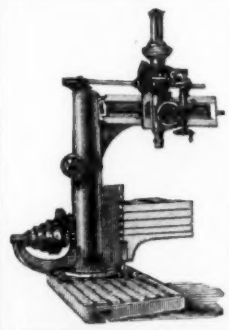

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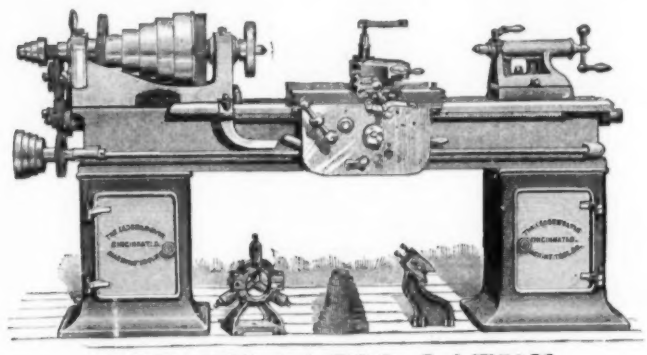

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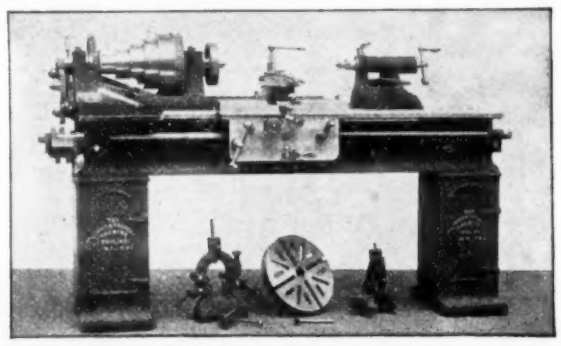

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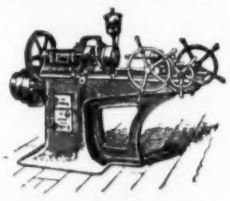

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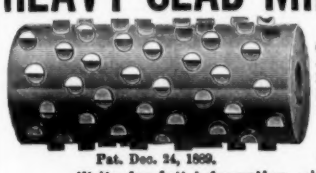

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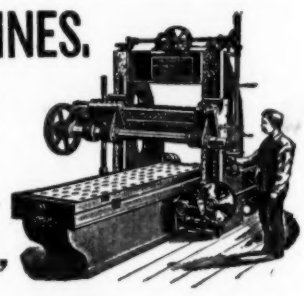

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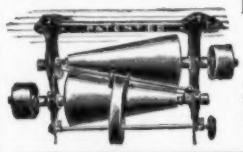

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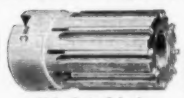
Adjustable  SHELL REAMERS

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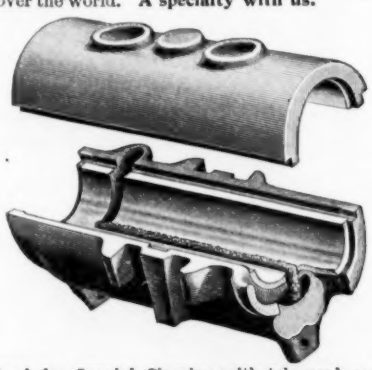

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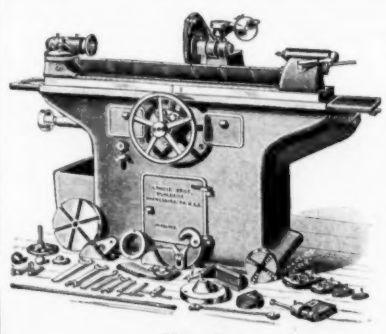

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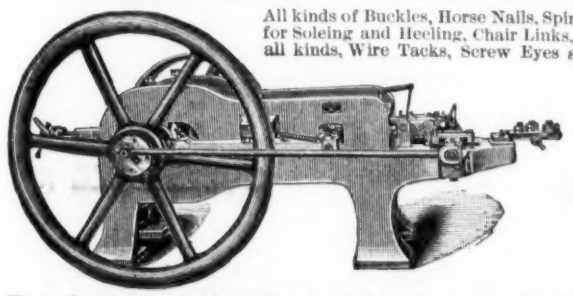

All kinds of Buckles, Horse Nails, Spiral Springs, Tin-opening Keys, Nails for Soleing and Heeling, Chair Links, Box and Coffin Handles, Rivets of all kinds, Wire Tacks, Screw Eyes and Screw Hooks, Cramps, Hinges, Lock and Piano Nails, Hob Nails of all kinds, Corset Buttons, Sliding Bolts, Eyes, Loops, Leaden Rivets, Leads, Spring Bands, Square Nails for Heeling; Wire Bending and Wire Cutting Machines, Shaping Machines, Machines for making Hooks and Eyes for Ladies' Dresses, Trowsers Hooks and Trowsers Eyes, as well as Hooks and Eyes for Military Cloaks; Tacks and Rivet Presses, etc.

We are also prepared to furnish Machines for making a great many other articles not mentioned above, on receipt of Samples.

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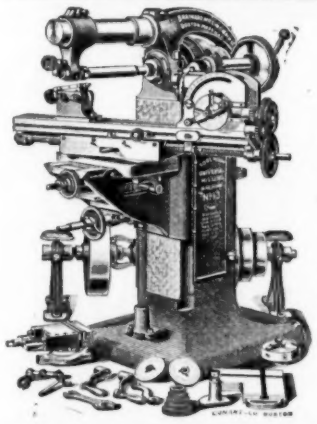

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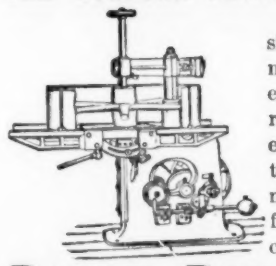

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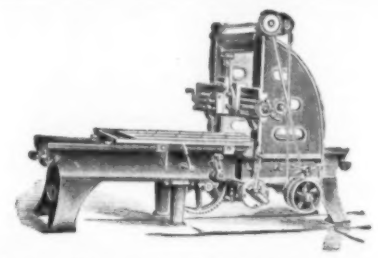

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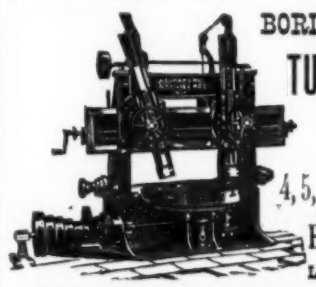

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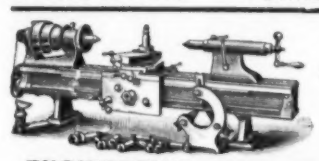

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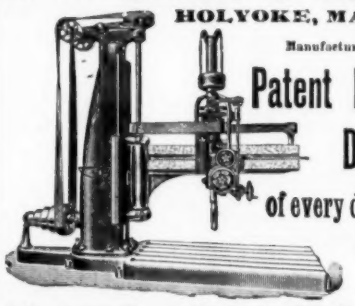

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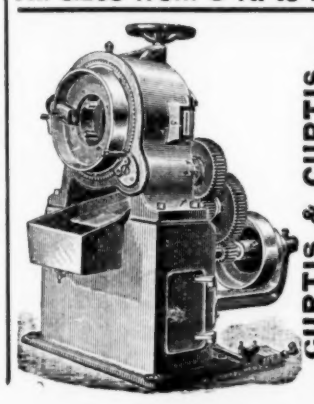

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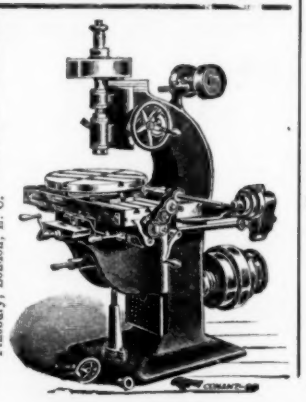

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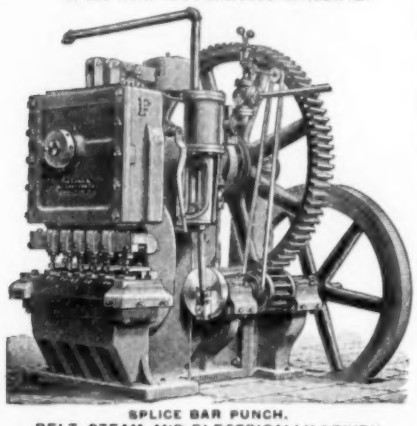

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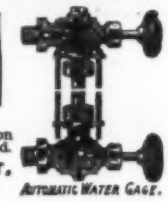

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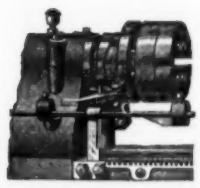

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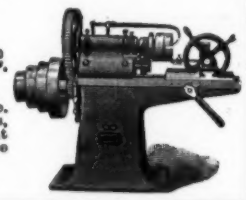

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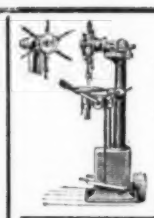

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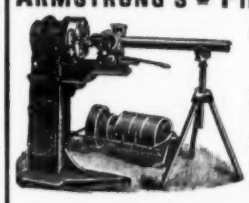

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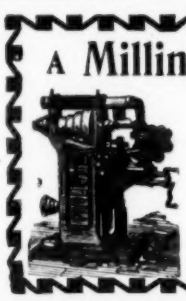

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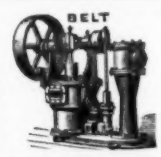

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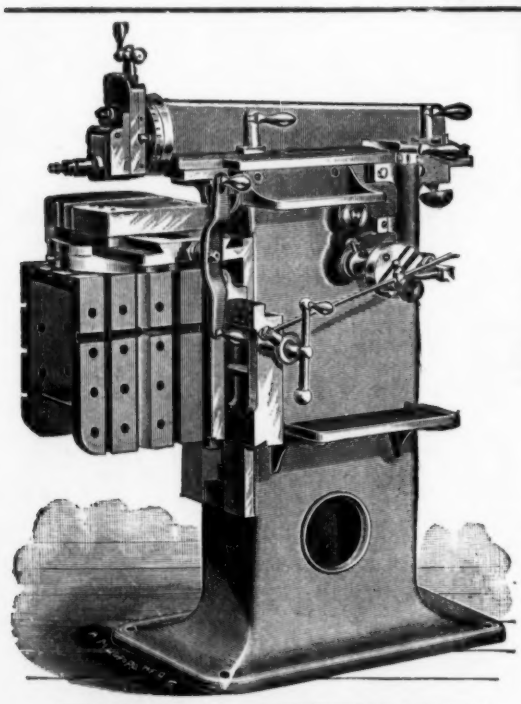

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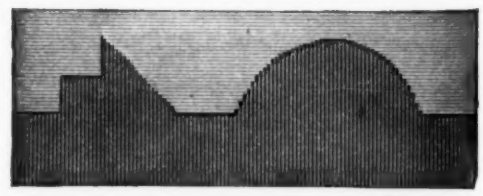

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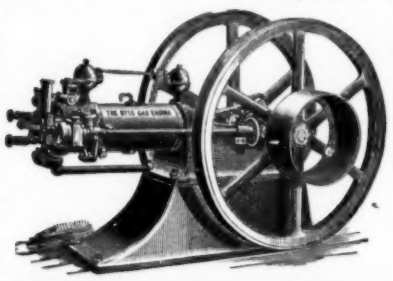

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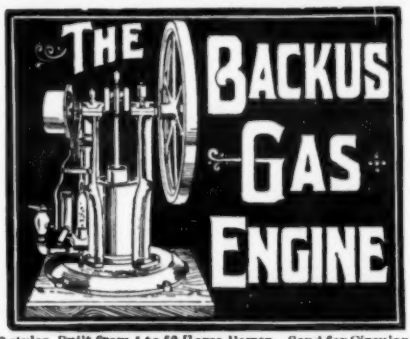

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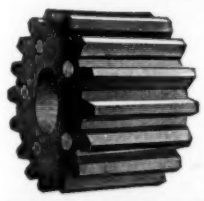

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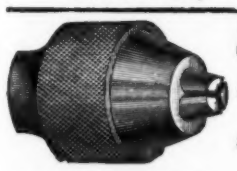

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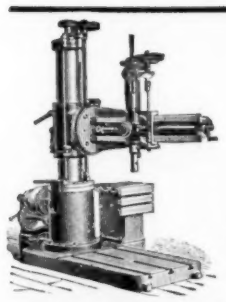

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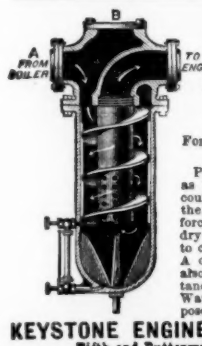

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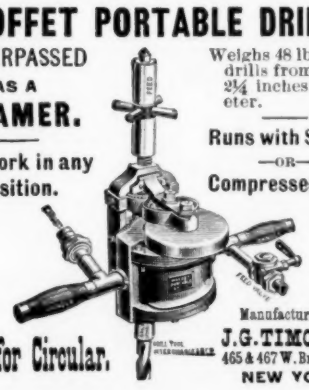

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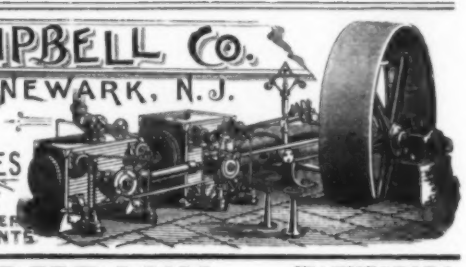

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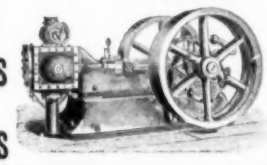

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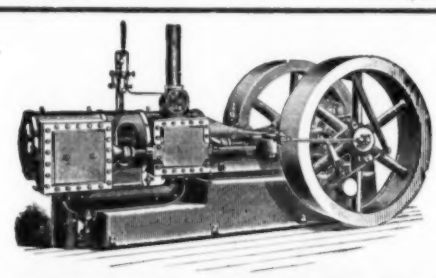

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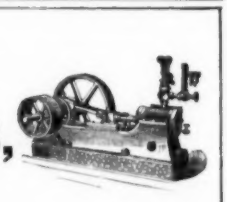

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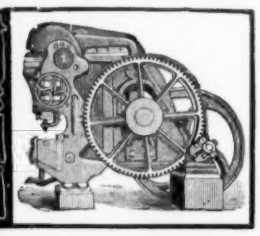

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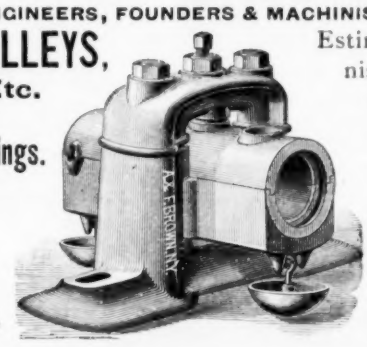

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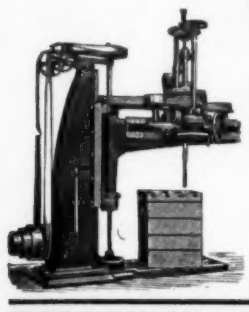

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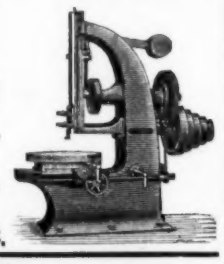

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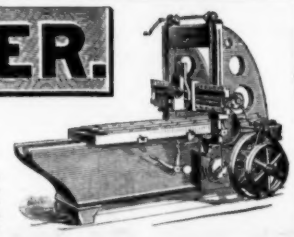

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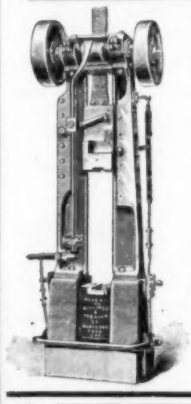

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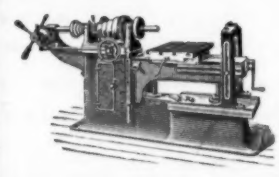

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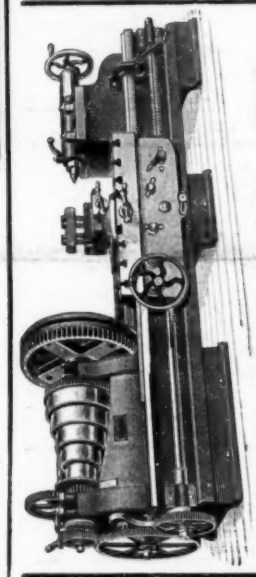

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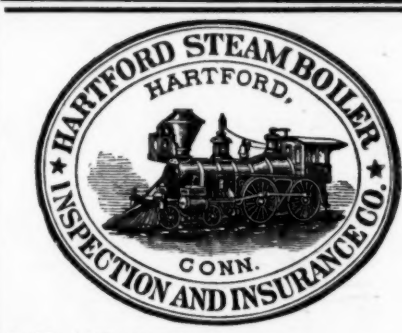

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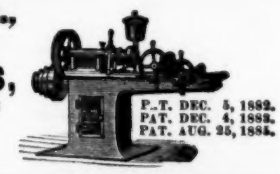

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